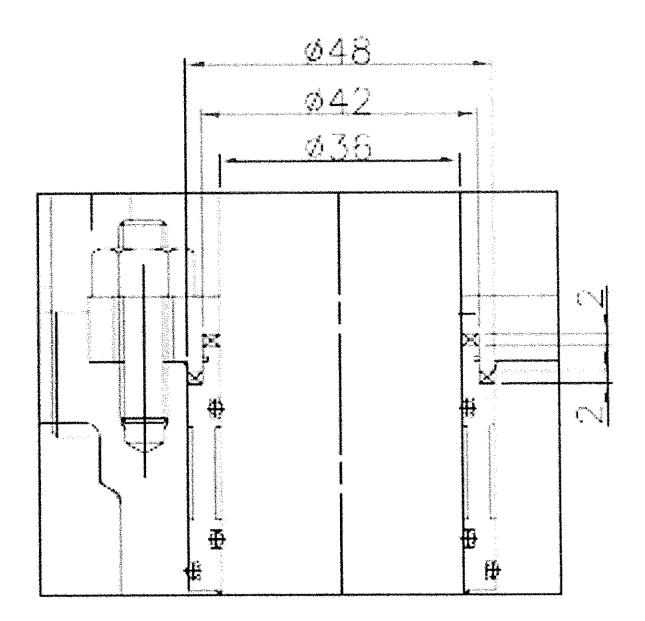
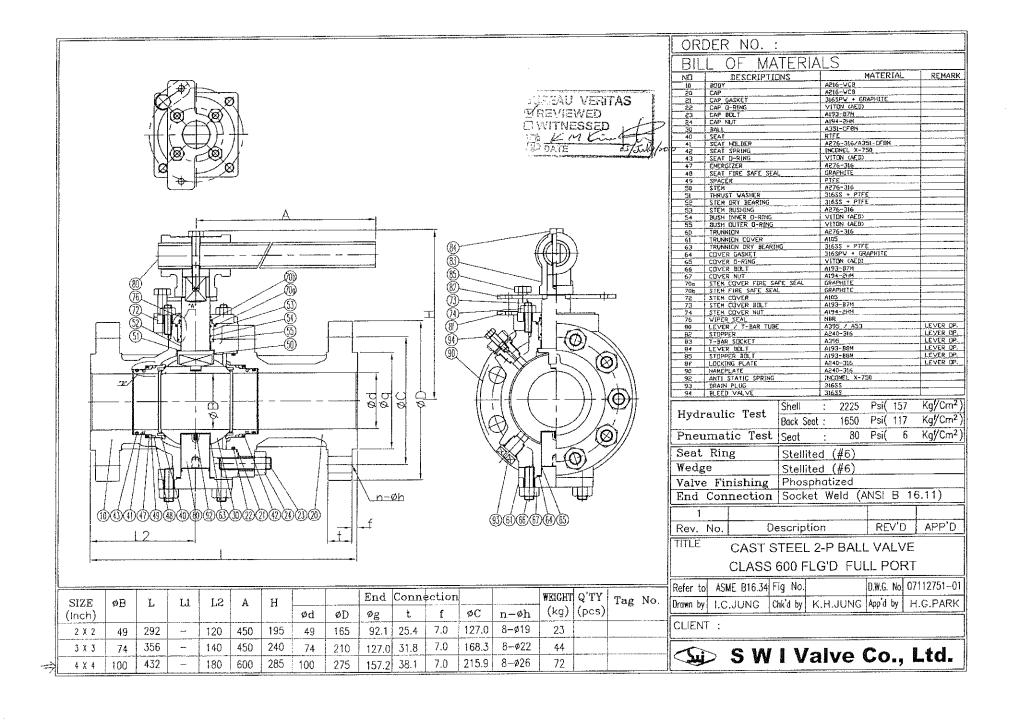


Ball Valve Gasket Area



Ball Valve Packing Area







# Energy & Process

# TYPE APPROVAL CERTIFICATE FOR GATE VALVE No. 940013/3-TC-01

| B.V. Job Ref:  |
|--|
| nspection ordered to B.V. by (1); SWI Valve Co. Ltd.   |
| #1023-2 Gwanyang 1-dong,Dongan-gu. Anyang-si, Gyeonggi-do, Korea   |
| Manufacturer : SWI Valve Co. Ltd., Korea   |
| (1) the addressee of the original of this certificate;   |
| Description of the Supply / Subject of inspection:  Product: Forged Steel Gate Valve Size of Tested Valve: 1* Material of Tested Valve: ASTM A105N Class of Tested Valve: #1500 Stem Diameter: 14.6 mm Tightness class: below 100ppm Endurance class: 1500cycles Temperature range: Room temperature to +260°C Packing Adjustment number: 0  |
| This certificate covers the whole of the supply:   YES (no more inspection planned)  NO (part of the supply still to be inspected)   |
| Scope of the B.V. Survey :   |
| - Witness for Type Test of Fugitive Emission Test  |
| - API 622 Type Testing of Process Valve Packing for Fugitive Emissions  (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.  List of enclosures: Test Report for Fugitive Emission Test  |
|  |
| Marking and Stamping on the items: NONE  Particulars or comments: This is to certify that the following valves have been inspected by Bureau Vertas and found to be satisfactory in The Fugitive Emission Test in accordance with API 622 First Edition, August 2006  Date of Issuance: 24-Mar-2011  |
| Location of inspection : BV-Korea, Seoul Office  |
| This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Ventas Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Ventas  This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any aguentic purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee lochgation and or indemnity. |
| Preloting to without amitation, patents, workmanship materials safety performance in operation and/or re/ability  Ad ME 96136  |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

| Reporting.  | SWI-FET-15  |  |
|-------------|-------------|--|
| ISSUED DATE | 16.Mar.2011 |  |
| CHECKED BY  | ManJong,Ko  |  |
| Approved By | Yongpyo,Cho |  |
| Page 1 of 3 |             |  |

# PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer : SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 02<sup>nd</sup> Mar,2011 to 04<sup>th</sup> Mar,2011

#### 1. VALVE SPECIFICATION

| Valve size & type  | GATE Valve A105N/13CRFS RF 1500#                 |  |
|--------------------|--|--|
|                    | BB RB 1"   |  |
| Material of Valve  | A105N  |  |
| Valve class        | 1500#  |  |
| Stem diameter      | 14.6 mm  |  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |  |
|                    | Model No. : PILLAR 6715+ 6610                    |  |
| Packing material   | GRAPHITE, GRAPHITE+INCONEL WIRE                  |  |
| Operating torque   | 51N/m  |  |
| Stroke             | 24.3 mm  |  |

#### 2. TEST CONDITION

| Test pressure                 | 208-256 bar  |             |  |
|-------------------------------|--|-------------|--|
| Test medium                   | He 99%   |             |  |
| Check medium                  | He 99%   |             |  |
| Test temperature              | RT/ 260℃   |             |  |
| Test equipment                | Fugitive emission test equip. manufactured by SWI VALVE CO. LTD. |             |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)                     |             |  |
| Sampling method               | Random   |             |  |
| Valve repacking before test   | 0  | EUMEAU VENI |  |
| Insulation of test valve      | Heating Jacket used  | MVITMESSEL  |  |
| Actuator                      | Geared motor   | LIG DATE    |  |

# A.1- Fugitive Emissions Test Report Summary

| pplication Profile : 0          | Check One             | W.A   |                       | Manufacturer: SW             | I VALVE CO. LTD. |                                       |
|---------------------------------|-----------------------|---|-----------------------|------------------------------|------------------|---------------------------------------|
| ☐ Rotating                      | ☑ Rising              |   |                       | Description: Gate            | A105 #1500 RF 1" |                                       |
| Testing Facility: SWI           | •                     |   |                       |                              |                  | h = 1 = 11                            |
| Technician: ManJong,Ko          |                       | Source: Manufacturer Date: 11 <sup>th</sup> Feb,2011  Distributor |                       |                              |                  |                                       |
| Start date: 02 <sup>ND</sup> Ma | rch,2011              | Completion: 04 <sup>Th</sup>                                      |                       | Packaged:<br>Indicate New or | □ New            |                                       |
| Gland Load<br>nformation psi.   |                       | land Nut Torque :29   | ft-lbs                | Current Product              | ☑ New ☑ Current  |                                       |
| Notes concerning ins            | tallation instruction | าธ  |                       |                              |                  |                                       |
|                                 |                       | Te  | sting Profile Details |                              |                  |                                       |
|                                 | Leak                  |   | Reference             | Flats Adjusted-              |                  |                                       |
| Table                           | measurement           |   | Temperature(°C)       | Gland Nut                    | Reference A      |                                       |
| Test Segment                    | (ppm)                 | Temperature('C)   | at packing gland      | Torque ft-lbs                | Height (mm)      | · · · · · · · · · · · · · · · · · · · |
| Day1                            | 0                     | Room temp.  | Room temp.            | 29                           | 44.49            |                                       |
| Start,Ambient                   | 0                     | Room temp.  | Room temp.            |                              | ~                |                                       |
| ararcy(HDI6HE                   | 0                     | Room temp.  | Room temp.            |                              |                  |                                       |
| 0-250 cycles                    | 4                     | Room temp.  | Room temp.            |                              |                  |                                       |
| P=256(bar)                      | 44                    | Room temp.  | Room temp.            |                              |                  |                                       |
|                                 | 2                     | Room temp.  | Room temp.            |                              |                  |                                       |
| High Temperature                | 25                    | 260°C   | 220°C                 |                              |                  |                                       |
| 250-500cycles                   | 29                    | 260°C   | 220℃                  |                              |                  |                                       |
| D=208/5\                        | 36                    | 260°C   | 220°C                 |                              |                  |                                       |
| P=208(bar)                      | 37                    | 260°C   | 220°C                 |                              |                  |                                       |
|                                 | 38                    | 260°C   | 220°C                 |                              |                  |                                       |
| Day2                            | 12                    | Room temp.  | Room temp.            |                              |                  |                                       |
| Start,Ambient                   | 26                    | Room temp.  | Room temp.            |                              |                  |                                       |
|                                 | 29                    | Room temp.  | Room temp.            |                              |                  |                                       |
| 500-750 cycles                  | 34                    | Room temp.  | Room temp.            |                              |                  |                                       |
| P=256(bar)                      | 39                    | Room temp.  | Room temp.            |                              |                  |                                       |
|                                 | 42                    | Room temp.  | Room temp.            |                              |                  |                                       |
| High Temperature                | 53                    | 260°C   | 220°C                 |                              |                  |                                       |
| 750-1000 cycles                 | 56                    | 260 C   | 220°C                 |                              |                  |                                       |
| ·                               | 58                    | 260°C   | 220℃                  |                              |                  |                                       |
| P=208(bar)                      | 62                    | 260°C   | 220 °C                |                              |                  |                                       |
|                                 | 65                    | 260°C   | 220°C                 |                              |                  |                                       |
| 5 2                             | 46                    | Room temp.  | Room temp.            |                              |                  |                                       |
| Day3                            | 43                    | Room temp.  | Room temp.            |                              |                  |                                       |
| Start,Amblent                   | 49                    | Room temp.  | Room temp.            |                              |                  |                                       |
| 1000-1250 cycles                | 61                    | Room temp.  | Room temp.            |                              |                  | ····· · · · · · · · · · · · · · · · · |
| •                               | 69                    | Room temp.  | Room temp.            |                              |                  | - 200 class                           |
| P=256(bar)                      | 70                    | Room temp.  | Room temp.            |                              | BURBAU           | /ENTAS                                |
| High Temperature                | 73                    | 260°C   | 220°C                 |                              | DREVIEW          | ED                                    |
| - ,                             | 79                    | 260 °C  | 220°C                 |                              | TO KERY A        | In FE                                 |
| 1250-1500cycles                 | 83                    | 260 °C  | 220°C                 |                              | 173 FATE         | 0,7/10                                |
| P=208(bar)                      |                       |   | 1                     |                              |                  |                                       |
|                                 | 89<br>92              | 260°C   | 220°C                 |                              |                  |                                       |

| AP! Std 622  |  |  |
|--|--|--|
| Emissions Tes  | ting Report Summary  |  |
| Test Number: SW1-FET-15                                      | Test Date: 02 <sup>ND</sup> to 04 <sup>TH</sup> MAR , 2011 |  |
| Packing Material: Graphite, Graphite+ inconel wire           | Style Number:  |  |
| Packing Manufacturer: PILLAR 6715+ 6610                      | Source of Sample; GATE A105N/13CRFS RF1500# BB RB 1"       |  |
| Test Packing Cross-section: Rectangle                        | Laboratory Name: SWI LABORATORY                            |  |
|  | Location of Test: SWI FACTORY                              |  |
| Packing Gland OD and ID(at the packing):                     | Packing Gland Bolt Diameter= 7.9 mm                        |  |
| OD= 23.9 ID= 14.2  |  |  |
| Number of Mechanical Cycles: 750                             | Packing Compression % of Free Height= 80%                  |  |
|  | Torque on Gland Nuts(each side)=29/29 (ft-lbs)             |  |
| Number of Thermal Cycles: 750                                | Mechanical Cycles Prior to Readjustment:                   |  |
|  | Non-applicable   |  |
| Maximum Test Pressure: 256 bar                               | Number of Readjustments: 0                                 |  |
| Packing Configuration: Graphite + Graphite with inconel wire | Show Sketch of Packing Installation-define each ring:      |  |
| Number of rings tested: 7                                    |  |  |
| Circle the following   |  |  |
| Ring shape(square, circular, vee)                            |  |  |
| Solid or split   |  |  |
| Braided  |  |  |
| Die formed   |  |  |
| Spool stock  |  |  |
|  |  |  |
| Wire or other reinforcement                                  |  |  |
| Corrosion inhibitor &type                                    |  |  |
|  |  |  |
| Other  |  |  |

| TEST CHECKED BY:                  | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| Man Jong , Ko                     | Yong Pyo, Cho                       |
| 4                                 | 4116                                |
| DATE: MAR 16 <sup>TH</sup> , 2011 | DATE: : MAR 16 <sup>TH</sup> , 2011 |





# TYPE APPROVAL CERTIFICATE FOR GATE VALVE No. 940013/3-TC-02

| Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.  |
|--|
|  |
| #1023-2 Gwanyang 1-dong.Dongan-gu, Anyang-si. Gyeonggi-do, Korea<br>Manufacturer : SWI Valve Co. Ltd., Korea   |
| (1) the adcressee of the original of this certificate :  |
|  |
| Description of the Supply / Subject of inspection:  Product: Forged Steel Gate Valve Size of Tested Valve: 1"  Material of Tested Valve: ASTM A105N Class of Tested Valve: #1500 Stem Diameter: 14.6 mm Tightness class: BH Endurance class: CO2(1500cycles) Temperature class: t400°C  Valves Qualified according to sizes: up to 2" (Stem Dia.: 7.3 to 29.2 mm) Valves Qualified according to pressure ratings: #150, #300, #600, #800, #1500 Valves Qualified according to Endurance class: BH Valves Qualified according to Endurance class: CO2(1500cycles) Valves Qualified according to temperature class: Room temperature to +400°C This certificate covers the whole of the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] The temperature to the supply: [St. VES (no more incoording teasead)] |
| This certificate covers the whole of the supply:   YES (no more inspection planned)  NO (part of the supply still to be inspected)   |
| Scope of the B.V. Survey :   |
| - Witness for Type Test of Fugitive Emission Test  |
| This supply complies with the following applicable document (s): (2) - ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.   |
| List of enclosures: Test Report for Fugitive Emission Test 6 Pages   |
| (or reference to enclosed list) The certificate is valid together with enclosures (if listed). Only pages of enclosures (or pages) which are stamped, are considered as part of this certific  |
| Marking and Stamping on the items: NONE  |
| Particulars or comments: This is to certify that the following valves have been inspected. Bureau Marias and found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15846-95 dition 2006.  Date of Issuance: 24-Mar-2011  |
| Location of inspection . BV-Korea, Seoul Office  |
| This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas<br>Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Veritas  |
| This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the menufacturer, supplier and any party from their respective duty, guarantee, coligation and/or indemnity relating to without limitation patents, workmanship, materials safety performance in operation and/or reliability.  |
|  |



FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| Report, No. | SWI-FET-14  |
|-------------|-------------|
| Issued Date | 16.MAR.2011 |
| CHECKED BY  | ManJong,Ko  |
| APPROVED BY | Yongpyo,Cho |
|             |             |

Page 1 of 6

# PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 2<sup>nd</sup> MAR,2011 to 3<sup>rd</sup> MAR,2011

#### 1. VALVE SPECIFICATION

| Valve size & type                     | GATE Valve A105N/13CRFS RF 1500#                 |  |
|---------------------------------------|--|--|
| , , , , , , , , , , , , , , , , , , , | BB RB 1"   |  |
| Material of Valve                     | A105N  |  |
| Valve class                           | 1500#  |  |
| Stem diameter                         | 14.6 mm  |  |
| Gland packing type                    | Graphite Bralded Packing+Graphite Molded Packing |  |
|                                       | Model No. : PILLAR 6715+ 6610                    |  |
| Packing material                      | GRAPHITE, GRAPHITE+INCONEL WIRE                  |  |
| Operating torque                      | 51N/m  |  |
| Stroke                                | 24.3 mm  |  |

#### 2. TEST CONDITION

| Test pressure                 | 174-256 bar                                   |                |  |
|-------------------------------|---|----------------|--|
| Test medium                   | He 99%  |                |  |
| Check medium                  | He 99%  |                |  |
| Test temperature              | RT/ 400°C                                     |                |  |
| Test equipment                | Fugitive emission test equip, manufactured by |                |  |
|                               | SWI VALVE CO. LTD.                            |                |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |                |  |
| Sampling method               | Random  |                |  |
| Valve repacking before test   | 0   | BUREAU VERITAS |  |
| Insulation of test valve      | Heating Jacket used                           | WITNESSED      |  |
| Actuator                      | Geared motor                                  | LIO DATE       |  |



# REPORT.No. SWI-FET-14 Issued Date 16.MAR.2011 CHECKED BY MANJONG, KO APPROVED BY YONGPYO, CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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#### 3. CONDITION FOR CYCLING TEST

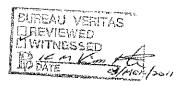
| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" +stem movement 8"+close 2") |

#### 4. DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### 5. TEST RESULTS

Test results are recorded in manufactures test report from next page.





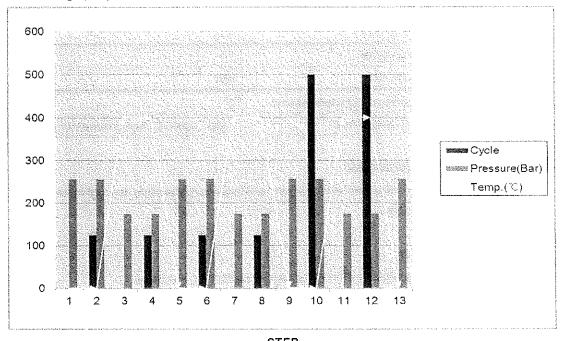
FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.NO.  | SWI-FET-14  |
|-------------|-------------|
| ISSUED DATE | 16.MAR.2011 |
| CHECKED BY  | ManJong,Ko  |
| APPROVED BY | Yongpyo,Сно |
|             |             |

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#### 6. TEST STEPS

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.

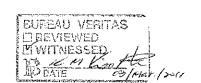


#### STEP

#### 7. TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

TEST FROM ROOM TEMPERATURE(-29℃ ~+40℃) to +400℃.



Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Body-Bonnet<br>Leakage(PPM) | Packing leakage<br>(atm x cm³ x s¹) |
|------------|---------------|-----------------------------|-------------------------------------|
| 256        | Room. Temp.   | 0                           | 5.8 ×10 <sup>-6</sup>               |

#### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage       |
|---------------|------------|---------------|-----------------------|
|               |            |               | (atm x cm³ x s-1)     |
| 125           | 256        | Room, Temp.   | 7.5 x10 <sup>-6</sup> |

FORM-FET-01 SWI VALVE CO.LTD.



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.  | SWI-FET-14  |
|-------------|-------------|
| ISSUED DATE | 16.MAR.2011 |
| CHECKED BY  | ManJong, Ko |
| APPROVED BY | Yongpyo,Cho |
|             |             |

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#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(°C) | Packing leakage      |
|------------|----------------|----------------------|
|            |                | (atm x cm³ x s⁻¹)    |
| 174        | 400            | 8.8x10 <sup>-6</sup> |

#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles | Pres.(BAR) | Body Temp.(°C) | Packing leakage       |
|---------------|------------|----------------|-----------------------|
|               |            |                | (atm x cm³ x s⁻¹)     |
| 125           | 174        |                | 9.3 x10 <sup>-6</sup> |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Packing leakage      |
|------------|---------------|----------------------|
|            |               | (atm x cm³ x s⁻¹)    |
| 256        | Room. Temp.   | 8.6x10 <sup>-6</sup> |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 256        | Room. Temp.   | 9.3 x10 <sup>-6</sup>                      |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |
|------------|----------------|--|
|            |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 174        | 400            | 1.2 ×10 <sup>-5</sup>                      |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles | Pres.(BAR) | Body Temp.(°C) | Packing leakage       |
|---------------|------------|----------------|-----------------------|
|               |            |                | (atm x cm³ x s¹)      |
| 125           | 174        | 400            | 1.4 x10 <sup>-8</sup> |

# - In this point, One Packing adjustment is taken for re-tightening.

Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| /          |               |                       | Control of the Contro |  |
|------------|---------------|-----------------------|--|--|
| Pres.(BAR) | Body Temp.(℃) | Packing leakage       | Packing torque   |  |
|            |               |                       | Nm   |  |
| 256        | Room temp.    | 9.7 x10 <sup>-6</sup> | 39   |  |

FORM-FET-01

BUREVIEWED

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#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORTINO.  | SWI-FET-14   |
|-------------|--------------|
| Issued Date | 16.MAR.2011  |
| Снескед Ву  | ManJong, Ko  |
| APPROVED BY | Yongpyo, Cho |
|             |              |

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#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |  |
|---------------|------------|---------------|--|--|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |
| 500           | 256        | Room, Temp.   | 1.1 x10 <sup>-5</sup>                      |  |  |

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400℃

| Pres.(BAR) | Body Temp.(°C) | Packing leakage       |
|------------|----------------|-----------------------|
|            |                | (atm x cm³ x s⁻¹)     |
| 174        | , , , ,        | 1.2 x10 <sup>-5</sup> |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |  |  |  |
|---------------|------------|----------------|--|--|--|--|
|               |            | :              | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |  |
| 500           | 174        | 400            | 1.6x10 <sup>-5</sup>                       |  |  |  |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres.(BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage       |  |  |
|------------|---------------|--------------|-----------------------|--|--|
|            |               | leakage(PPM) | (atm x cm³ x s⁻¹)     |  |  |
| 256        | Room Temp.    | 36           | 9.7 x10 <sup>-6</sup> |  |  |

#### POST TEST EXAMINATION

No visible damage or wear on stem packing area



FORM-FET-01

SWI VALVE CO.LTD.



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| the second secon |             |
|--|-------------|
| REPORT.No.   | SWI-FET-14  |
| Issued Date  | 16.MAR.2011 |
| CHECKED BY   | ManJong,Ko  |
| APPROVED BY  | Yongpyo,Cho |
|  |             |

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#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS B                   |
|---------------------------|---------------------------|
| Body & bonnet gasket seal | ≤50 ppmv                  |
| Stuffing box stem seal    | ≤10⁴(mgxs⁻¹xm⁻¹)          |
|                           | Equivalent to             |
|                           | ≤5.6x10⁴(atm x cm³ x s⁻¹) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

stuffing box packing seal : stem diameter 14.6 mm

|                        | CLASS B  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter( 0.0146m ) xπx5.6x 10 <sup>-4</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
|                        | = $2.57 \times 10^{-6} \text{ (atm x cm}^3 \text{ x s}^{-1}\text{)}$                         |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: BH** 

With one packing adjusted < SSA1> for re tightening

**ENDURANCE CLASS:** 

CO2 1,500 cycles

**TEMPERAUTRE CLASS:** 

Room temperature to 400 °C

Performance class: ISO FE BH- CO2 - SSA1 - t- (400°C)-CL800- ISO 15848-1

EUREAU VERITAS
ID FEVIEWED
ISTWITNESSED

ED DATE

BOTATE

DOTATE

TEST CHECKED BY: TEST APPROVED BY:

Man Jong , Ko

Yong Pyo, Cho

DATE: MAR 16<sup>TH</sup> , 2011 DATE: : MAR 16<sup>TH</sup> , 2011





SWI Valve Co., Ltd.

**TEST/INSPECTION CERTIFICATE** 

DATE: 2011, 02, 11

SWI ORDER NO.: SO2010100089

Head office & Plant 1: 1023-2 Gwangang-dong, Dongwi-gu, Anyang si, Gyeonggi-co, Korea Tel +82 31 421 1831—3 Fax.+82 31 421 1854 Marti 2 : 601-1 Garyeom-ri, Cheongbax-nyeon, Pyeongraek-si, Gyeongg-da, Korea Tell +92 31 684 2981~3 Fax +82 31 684 2984 www.swivasve.com

CERTIFICATE NO.

: 100089-3

PROJECT NAME / NO: Fugitive Emission Test Sample

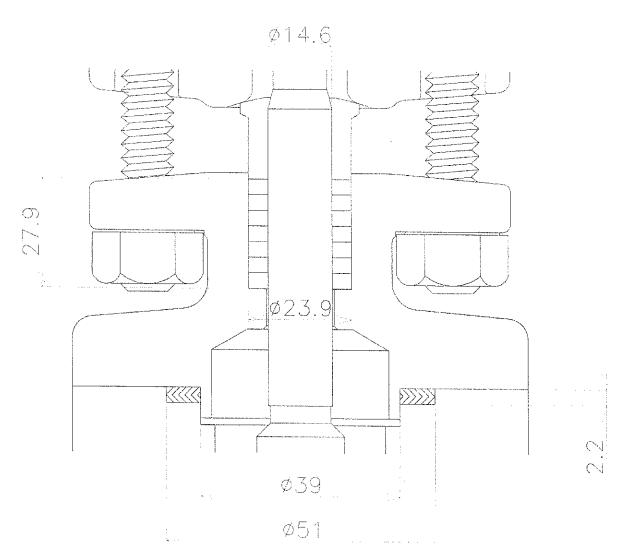
CUSTOMER/CLIENT - SWI Valve Co. Ltd.

PO NO :

| TAG NO. | ITEM DESCRIPTION   | Class<br>Press   | SIZE<br>(inch)       | E<br>h) Q'ty | Hydrostatic Test<br>(kg/cm²) |                    | Air Test<br>(kg/cm²) | Materials(ASTM)             |  |              |                       | Dimen    | Visual<br>Inspe | Functi<br>-onal | Result  |
|---------|--|--|----------------------|--------------|------------------------------|--------------------|----------------------|-----------------------------|--|--------------|-----------------------|----------|-----------------|-----------------|---------|
| TAO NO. | TIEM DECOMM NON  | -ure   | (inch)               |              | Shell                        | Seat /<br>Backseat | Seat                 | Body &<br>Bonnet            | Seat Ring<br>(Seat)  | Stem         | Wedge/ Disc<br>(Ball) | Check    | -ction          | Test            |         |
|         | GATE V/V RF  | 1500#  | 1"                   | 1            | 392                          | N.A/289            | 6                    | A105N                       | A276-410/HF  | A276-410     | A217-CA15/HF          | GOOD     | GOOD            | GOOD            | ACCEPTE |
|         |  |  |                      |              |                              |                    |                      |                             |  | - NAVIDO - I |                       |          |                 |                 |         |
|         | The second on the second behaviorable of shoot for the second of the sec | - M. State Control of the Control of |                      |              |                              |                    |                      |                             | The state of the s |              |                       |          |                 | ļ               |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       | <u> </u> |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  |  | 1                    |              |                              |                    |                      |                             |  |              |                       | <b>_</b> |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  |  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
| , ,     |  | ···  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
|         |  | -  |                      |              |                              |                    |                      |                             |  |              |                       |          |                 |                 |         |
| Remarks | 1. These standard for in<br>2. HF: STELLITE NO. 6  | spection of Hard Fa  | i<br>conform<br>cing | to API       | 1<br>598                     |                    | <u> </u>             | ELVENTE<br>DATE<br>TALENTEN | VENTAS<br>VED<br>SSED<br>VED SOED  |              | ssed / Reviewe        | ed by Cu | ustome          | r Rep.          | 1       |

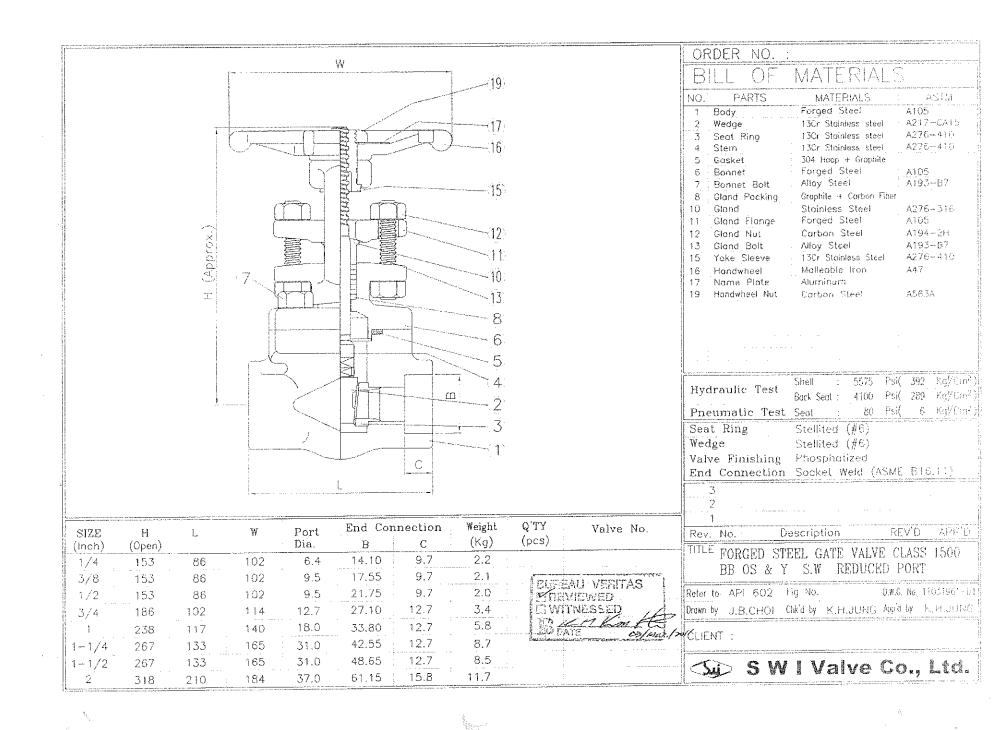
WE HEREBY CERTIFY THAT THE RESULTS MENTIONED ABOVE ARE TRUE AND CORRECT IN EVERY DETAIL

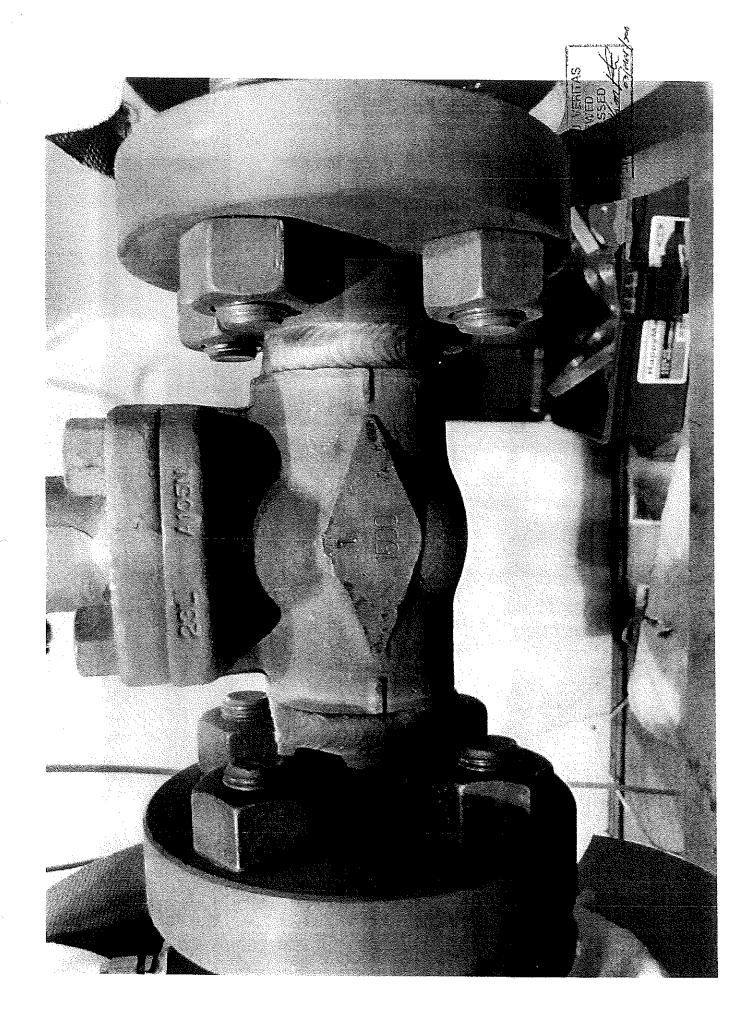
1 of 1

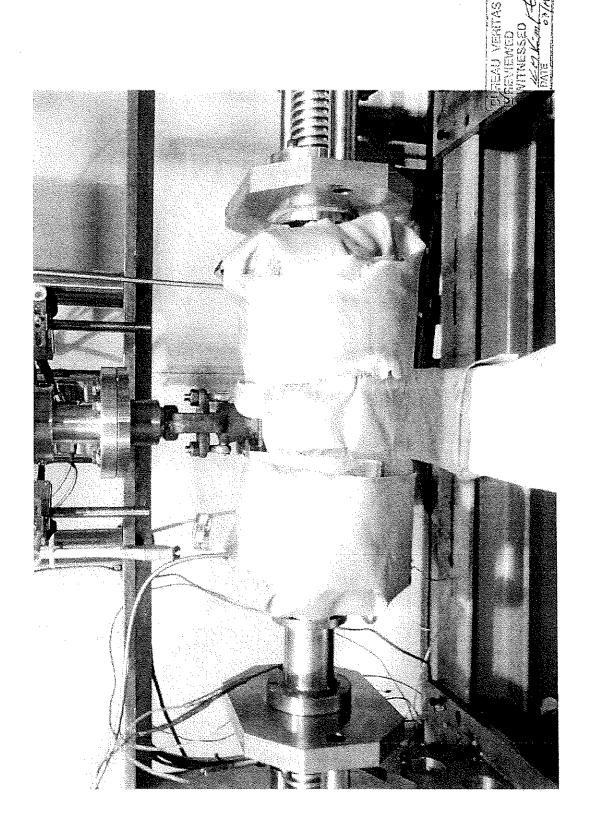


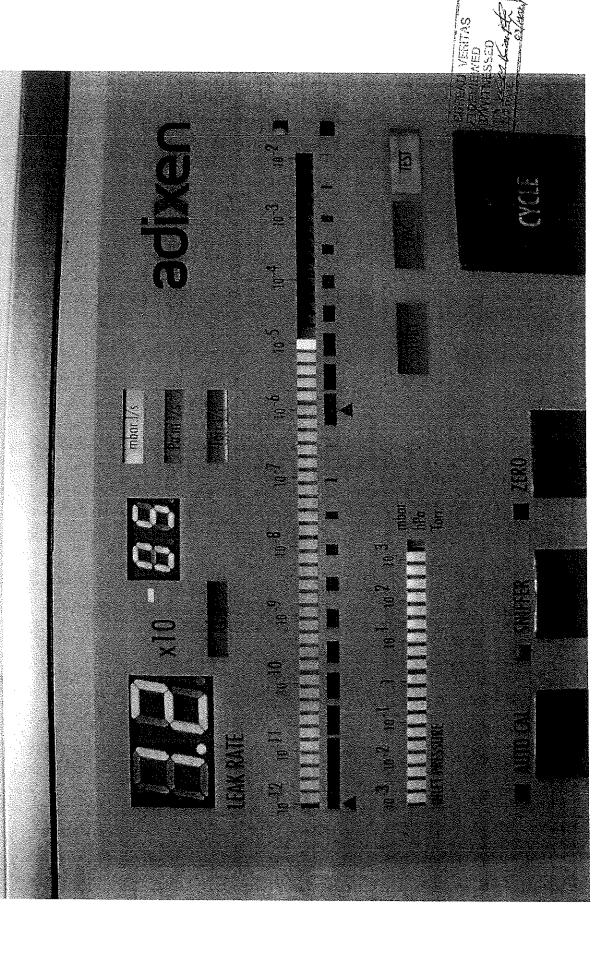
# GATE

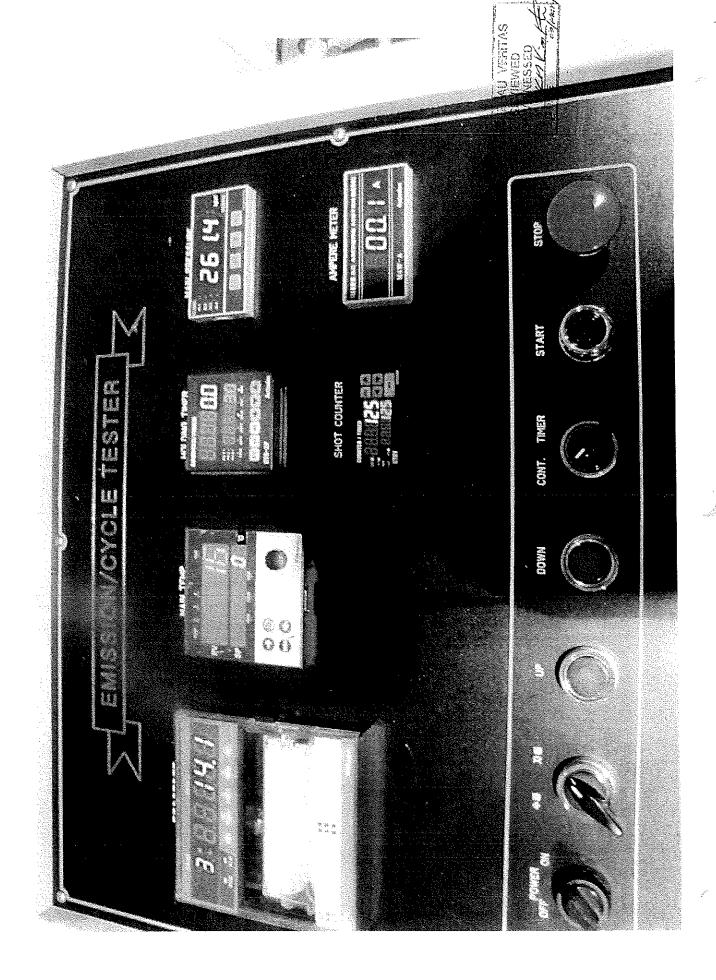














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MAIN TEMP.

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SHOT COUNTER

CENTRAL CARRIED





CONT. TIMES













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2



















# TYPE APPROVAL CERTIFICATE FOR GLOBE VALVE No. 940013/3-TC-03

| B.V. Job Ref :3.30.1030.03<br>Inspection ordered to B.V. by (1) : SWI Valve Co. Ltd.  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|
| #1023-2 Gwanyang 1-dong,Dongan-gu Anyang-si, Gyeonggi-do, Korea   |  |  |  |  |  |  |
| Manufacturer : SWI Valve Co. Ltd., Korea  |  |  |  |  |  |  |
| (1) the addressee of the original of this certificate:  |  |  |  |  |  |  |
| Description of the Supply / Subject of inspection: Product: Forged Steel Globe Valve Size of Tested Valve: 1" Material of Tested Valve: ASTM A105N Class of Tested Valve: #1500 Stem Diameter: 16 0 mm Tightness class: below 100ppm Endurance class: 1500cycles Temperature range: Room temperature to +260°C Packing Adjustment number: 0   |  |  |  |  |  |  |
| This certificate covers the whole of the supply:   YES (no more inspection planned)   NO (part of the supply still to be inspected)   |  |  |  |  |  |  |
| Scope of the B.V. Survey :  |  |  |  |  |  |  |
| - Witness for Type Test of Fugitive Emission Test   |  |  |  |  |  |  |
| This supply complies with the following applicable document (s): (2)  - API 622 Type Testing of Process Valve Packing for Fugitive Emissions (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.  List of enclosures: Test Report for Fugitive Emission Test  |  |  |  |  |  |  |
| Marking and Stamping on the items: NONE   |  |  |  |  |  |  |
| Particulars or comments: This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactor.  The Fugitive Emission Test in accordance with API 622 First Edition, August 2006.  Date of Issuance: 24-Mar-2011  |  |  |  |  |  |  |
| Location of inspection: BV-Korea, Seoul Office  |  |  |  |  |  |  |
| Ce Certificat est délivre dans le cadre des Conditions Générales de Servida du Bureau Ventes  |  |  |  |  |  |  |
| This carlificate is issued further to an inspection whose duration and scope were invited by the terms and conditions of the contract with BV crinopal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee obligation and/or indemnity relating to, without limitation, patents workmenship materials safety, performance in operation and/or reliability.  Ad ME 95135 |  |  |  |  |  |  |
| 2.58 3EM 270 (172)  |  |  |  |  |  |  |



FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

| REPORT.No.  | SWI-FET-17  |  |  |
|-------------|-------------|--|--|
| ISSUED DATE | 16.Mar.2011 |  |  |
| Снескед Ву  | ManJong,Ko  |  |  |
| APPROVED BY | Yongpyo,Cho |  |  |
| Page 1 of 3 |             |  |  |

# PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer : SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 18<sup>th</sup> Feb,2011 to 20<sup>th</sup> Feb,2011

#### 1. VALVE SPECIFICATION

| Valve size & type  | GLOBE Valve A105N/13CRFS RF 1500#                |
|--------------------|--|
|                    | BB RB 1"   |
| Material of Valve  | A105N  |
| Valve class        | 800#   |
| Stem diameter      | 16.0 mm  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |
|                    | Model No.: PILLAR 6715+ 6610                     |
| Packing material   | GRAPHITE, GRAPHITE+INCONEL WIRE                  |
| Operating torque   | 51 N/m   |
| Stroke / Angle     | 7.8 mm   |

#### 2. TEST CONDITION

| Test pressure                 | 208-256 bar  |  |  |  |  |
|-------------------------------|--|--|--|--|--|
| Test medium                   | He 99%<br>He 99%   |  |  |  |  |
| Check medium                  |  |  |  |  |  |
| Test temperature              | RT/ 260℃   |  |  |  |  |
| Test equipment                | Fugitive emission test equip, manufactured by SWI VALVE CO. LTD. |  |  |  |  |
|                               |  |  |  |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)                     |  |  |  |  |
| Sampling method               | Random   |  |  |  |  |
| Valve repacking before test   | 0 CUPRALLY   |  |  |  |  |
| Insulation of test valve      | Heating Jacket used PWYYNESS                                     |  |  |  |  |
|                               |  |  |  |  |  |

SALTAS

Actuator

Geared motor

# A.1- Fugitive Emissions Test Report Summary

| API Std 622                          |  |                                 | 370000000000000000000000000000000000000 |                   | 1912  |   |
|--------------------------------------|--|---------------------------------|---|-------------------|---|---|
|                                      | Fugitive Emis  | ssions Testing Report           | Number: SWI-FET-                        | 17                |   |   |
| Application Profile : 0              | Check One  |                                 |   | Manufacturer: SW  | I VALVE CO. LTD.                            |   |
|                                      | 2 Rising   |                                 |   | Description: Glob | e A105 1500# RF 1                           |   |
| Testing Facility: SWI                | 150  |                                 |   | C                 |   | TEED 0044                               |
| Technician: ManJong                  |  |                                 |   |                   | nufacturer Date: 7 <sup>t</sup><br>tributor | FEB,2011                                |
| Witness: Ki-Man , Ki                 |  | TU                              |   |                   | a ibator                                    |   |
| Start date: 18 <sup>TH</sup> FE      | В,2011   | Completion: 20 <sup>TH</sup> FE | EB,2011                                 | Packaged:         |   |   |
| Gland Load                           | The Control of the Co | Gland Nut Torque : 2            | 8 ft-lbs                                | Indicate New or   | ☐ New                                       |   |
| Information psi.                     |  |                                 |   | Current Product   | ☑ Current                                   |   |
| Notes concerning ins                 | stallation instruction   | ns                              |   |                   |   |   |
|                                      |  | To                              | sting Profile Details                   |                   |   |   |
|                                      | Leak   | 10                              | Reference                               | Flats Adjusted-   |   |   |
|                                      | measurement  |                                 | Temperature(°C)                         | Gland Nut         | Reference A                                 |   |
| Test Segment                         | (ppm)  | Temperature('C)                 | at packing gland                        | Torque ft-lbs     | Height (mm)                                 |   |
| Day1                                 | 0  | Room temp.                      | Room temp.                              | 28                | 44.5  |   |
|                                      | 0  | Room temp.                      | Room temp.                              |                   |   |   |
| Start,Ambient                        | 0  | Room temp.                      | Room temp.                              |                   |   |   |
| 0-250 cycles                         | 4  | Room temp.                      | Room temp.                              |                   |   |   |
| P=256(bar)                           | 4  | Room temp.                      | Room temp.                              |                   |   |   |
|                                      | 6  | Room temp.                      | Room temp.                              |                   |   |   |
| High Temperature                     | 22   | 260 C                           | 220 C                                   |                   |   |   |
| 250-500cycles                        | 27   | 260°C                           | 220 C                                   |                   |   |   |
|                                      | 35   | 260℃                            | 220°C                                   |                   |   |   |
| P=208(bar)                           | 36   | 260°C                           | 220°C                                   |                   |   |   |
|                                      | 38   | 260°C                           | 220 C                                   |                   |   | 10.000000000000000000000000000000000000 |
|                                      | 10   | Room temp.                      | Room temp.                              |                   |   |   |
| Day2                                 | 22   | Room temp.                      | Room temp.                              |                   |   | *************************************** |
| Start, Ambient                       | 24   | Room temp,                      | Room temp.                              |                   |   |   |
| 500-750 cycles                       | 31   | Room temp.                      | Room temp.                              |                   |   |   |
| P=256(bar)                           | 36   | Room temp.                      | Room temp.                              |                   |   |   |
| r-230(Dail)                          | 41   | Room temp.                      | Room temp.                              |                   |   |   |
| High Temperature                     | 49   | 260°C                           | 220°C                                   |                   | -   |   |
| · ·                                  | 52   | 260°C                           | 220°C                                   | -                 |   |   |
| 750-1000 cycles                      | 52   | 260°C                           | 220°C                                   |                   |   |   |
| P=208(bar)                           | 57   | 260 °C                          | 220°C                                   |                   |   |   |
|                                      | 59   | 260°C                           | 220°C                                   |                   |   |   |
|                                      | 43   | Room temp.                      | Room temp.                              |                   |   |   |
| Day3                                 | 45   | Room temp.                      | Room temp.                              |                   |   |   |
| Start, Ambient                       | 46   |                                 |   |                   |   |   |
| 1000-1250 cycles                     | 55   | Room temp.                      | Room temp.                              |                   |   |   |
| and the second account of the second |  | Room temp.                      | Room temp.                              |                   |   |   |
| P=256(bar)                           | 57   | Room temp.                      | Room temp.                              |                   |   |   |
| lieb Teese                           | 62   | Room temp.                      | Room temp.                              | <u> </u>          | F11 _ 1 F2 A                                | 51 4/230-1-20                           |
| High Temperature                     | 68   | 260℃                            | 220°C                                   |                   | Linev                                       | U VERITAS<br>LEWIED                     |
| 1250-1500cycles                      | 72   | 260 C                           | 220°C                                   | ļ                 |   | WESSED -                                |
| P=208(bar)                           | 78   | 260°C                           | 220°C                                   | <u> </u>          | 1000  | FIK ME                                  |
| an managarii Marandii                | 79   | 260°C                           | 220°C                                   |                   | International Control                       | Exercise Soffieh                        |
|                                      | 85   | 260°C                           | 220 C                                   |                   |   |   |

| API Std 622   |  |  |
|---|--|--|
| Emissions Testi   | ng Report Summary  |  |
| Test Number: SWI-FET-17   | Test Date: 18 <sup>th</sup> to 20 <sup>th</sup> FEB , 2011                           |  |
| Packing Material: Graphite, Graphite+ inconel wire  | Style Number:  |  |
| Packing Manufacturer: PILLAR 6715+ 6610   | Source of Sample: GLOBE A105N/13CRFS RF BB RB 1500# 1"                               |  |
| Test Packing Cross-section: Rectangle   | Laboratory Name: SWI LABORATORY  |  |
|   | Location of Test: SWI FACTORY  |  |
| Packing Gland OD and ID(at the packing):  OD= 25.5 ID= 15.9   | Packing Gland Bolt Diameter= 7.9 mm  |  |
| Number of Mechanical Cycles: 750  | Packing Compression % of Free Height= 80%  |  |
|   | Torque on Gland Nuts(each side)= 28/28 (ft-lbs)                                      |  |
| Number of Thermal Cycles: 750  Maximum Test Pressure: 256 bar   | Mechanical Cycles Prior to Readjustment:  Non-applicable  Number of Readjustments: 0 |  |
| Packing Configuration: Graphite + Graphite with inconel wire  Number of rings tested: 7  Circle the following  Ring shape (square, circular, vee)  Solid or split  Braided  Die formed  Spool stock  Wire or other reinforcement  Corrosion inhibitor &type | Show Sketch of Packing Installation-define each ring:                                |  |
| Corrosion inhibitor &type Other   |  |  |

TEST CHECKED BY: TEST APPROVED BY:

Man Jong , Ko

Yong Pyo, Cho

DATE: MAR 16<sup>TH</sup> , 2011

DATE: MAR 16<sup>TH</sup> , 2011

DESCRIPTION OF THE POINT OF THE

3



# TYPE APPROVAL CERTIFICATE FOR GLOBE VALVE No. 940013/3-TC-04

No. 940013/3-TC-04 B.V. Job Ref :3.30.1030.03 Inspection ordered to B.V. by (1); SWI Valve Co. Ltd. #1023-2 Gwanyang 1-dong.Dongan-gu Anyang-si, Gyeonggi-do, Korea Manufacturer : SWI Valve Co. Ltd., Korea (1) the addresses of the original of this certificate Description of the Supply / Subject of inspection: Product: Forged Steel Globe Valve Size of Tested Valve : 1" Material of Tested Valve: ASTM A105N Class of Tested Valve: #1500 Stem Diameter: 16.0 mm Tightness class: BH Endurance class : CO2(1500cycles) Temperature class: t400°C Valves Qualified according to sizes : up to 2" (Stem Dia. : 8.0 to 32.0 mm) Valves Qualified according to pressure ratings: #150, #300, #600, #800 #1500 Valves Qualified according to tightness class: BH Valves Qualified according to Endurance class: CO2(1500cycles) Valves Qualified according to temperature class. Room temperature to +400°C This certificate covers the whole of the supply: 

YES (no more inspection planned) 

NO (part of the supply still to be inspected) Scope of the B.V. Survey: - Witness for Type Test of Fugitive Emission Test This supply complies with the following applicable document (s): (2) - ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas. List of enclosures: Test Report for Fugitive Emission Test ------ 6 Pages The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate. Marking and Stamping on the Items: NONE Particulars or comments: VER This is to certify that the following valves have been inspected by found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15848-1 Edition Date of Issuance: 24-Mar-2011 Issued by EOUL Date of last inspection: 18 to 19-Feb-2011 Name: K. M. Kim Sign: Location of inspection: BV-Korea, Seoul Office This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Veritas This certificate is issued further to an inspection whose duration and scope

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal.

This certificate is NOT an indication that the item(s) is large fit for any specific purpose and does not release the manufacturer, supplier and any carty from their respective duty, guarantee, otheration and/or indemnity relating to, without limitation, patients, workmanship, materials, safety performance in operation and/or reliability.

Ad ME 9813b



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| - |               | Company of the Compan |  |  |  |  |
|---|---------------|--|--|--|--|--|
|   | REPORT, NO.   | SWI-FET-16   |  |  |  |  |
|   |               | 0,7,1,2,1,5  |  |  |  |  |
|   |               |  |  |  |  |  |
|   | ISSUED DATE   | 16.MAR.2011  |  |  |  |  |
|   | 1000ED DATE   | 10.1001.2011   |  |  |  |  |
|   | CHECKED BY    | ManJong,Ko   |  |  |  |  |
|   | APPROVED BY   | Yongpyo,Cho  |  |  |  |  |
|   |               |  |  |  |  |  |
|   |               |  |  |  |  |  |
|   | I Page 1 of 6 |  |  |  |  |  |

# PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

Date of Test: 18<sup>th</sup> FEB,2011 to 19<sup>th</sup> FEB,2011 3.

#### 1. VALVE SPECIFICATION

| Valve size & type       | GLOBE Valve A105N/13CRFS RF 1500#                |  |
|-------------------------|--|--|
|                         | BB RB 1"   |  |
| Material of Valve       | A105N  |  |
| Valve class             | 1500#  |  |
| Stem diameter           | 16.0 mm  |  |
| Gland packing type      | Graphite Braided Packing+Graphite Molded Packing |  |
|                         | Model No. : PtLLAR 6715+ 6610                    |  |
| Packing material        | GRAPHITE, GRAPHITE+INCONEL WIRE                  |  |
| Operating torque 51 N/m |  |  |
| Stroke / Angle          | 7.8mm  |  |

#### 2. TEST CONDITION

| Test pressure                 | 174-256 bar                                   |  |  |
|-------------------------------|---|--|--|
| Test medium                   | He 99%  |  |  |
| Check medium                  | He 99%  |  |  |
| Test temperature              | RT/ 400℃                                      |  |  |
| Test equipment                | Fugitive emission test equip. manufactured by |  |  |
|                               | SWI VALVE CO. LTD.                            |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |  |  |
| Sampling method               | Random  |  |  |
| Valve repacking before test   | 0 DUREVIEWED                                  |  |  |
| Insulation of test valve      | Heating Jacket used                           |  |  |
| Actuator                      | Geared motor                                  |  |  |

FORM-FET-01

SWI VALVE CO.LTD.



REPORT.No. SWI-FET-16

ISSUED DATE 16.MAR.2011

CHECKED BY MANJONG,KO

APPROVED BY YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

Page 2 of 6

### 3. CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" +stem movement 8"+close 2") |

#### 4. DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### 5. TEST RESULTS

Test results are recorded in manufactures test report from next page.



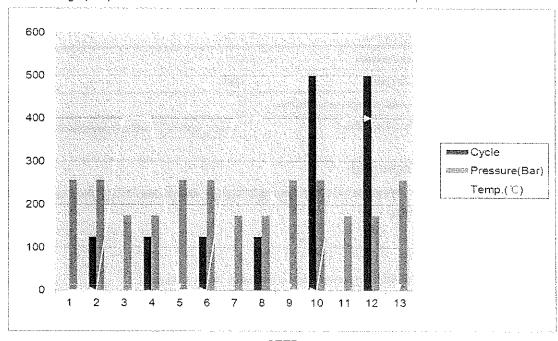


FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.   | SWI-FET-16   |  |  |  |
|--------------|--------------|--|--|--|
| Issued Date  | 16.MAR.2011  |  |  |  |
| Снескер Ву   | ManJong, Ko  |  |  |  |
| APPROVED BY  | Yongpyo, Cho |  |  |  |
| l'age 3 of 6 |              |  |  |  |

#### 6. TEST STEPS

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### STEP

#### 7. TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

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LIBEVIEWED
ETWITNESSED
TO ATTENDED
TO ATTENDE
TO ATTENDED
TO ATTENDED
TO ATTENDED
TO ATTENDED
TO ATTENDE

TEST FROM ROOM TEMPERATURE(-29℃ ~+40℃) to +400℃.

#### Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR)(BAR) | Body        | Body-Bonnet  | Packing leakage                            | Packing |
|-----------------|-------------|--------------|--|---------|
|                 | Temp.(℃)(℃) | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | torque  |
|                 |             |              |  | Nm      |
| 256             | Room. Temp. | 0            | 7.1 x10 <sup>-6</sup>                      | 39      |

Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles Pres.(BAR) |     | Body Temp.(℃) | Packing leakage       |
|--------------------------|-----|---------------|-----------------------|
|                          |     |               | (atm x cm³ x s¹¹)     |
| 125                      | 256 | Room, Temp.   | 8.2 x10 <sup>-6</sup> |



| REPORTINO,  | SWI-FE1-16  |
|-------------|-------------|
| Issued Date | 16.MAR.2011 |
| CHECKED BY  | Manjong,Ko  |
| APPROVED BY | Yongpyo,Cho |
|             |             |

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

Page 4 of 6

#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |
|------------|----------------|--|
|            |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 174        | 400            | 8.5 x10 <sup>-6</sup>                      |

#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles Pres.(BAR) |     | Body Temp.(℃) | Packing leakage       |
|--------------------------|-----|---------------|-----------------------|
|                          |     |               | (atm x cm³ x s¹)      |
| 125                      | 174 | 400           | 8.6 x10 <sup>-6</sup> |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(°C) | Packing leakage       |
|------------|----------------|-----------------------|
|            |                | (atm x cm³ x s⁻¹)     |
| 256        | Room. Temp.    | 7.2 x10 <sup>-6</sup> |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage       |
|---------------|------------|---------------|-----------------------|
|               |            |               | (atm x cm³ x s¹)      |
| 125           | 256        | Room. Temp.   | 1.2 x10 <sup>-5</sup> |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400℃

| Pres.(BAR) | Body Temp.(℃) | Packing leakage       |
|------------|---------------|-----------------------|
|            |               | (atm x cm³ x s⁻¹)     |
| 174        | 400           | 9.6 x10 <sup>-6</sup> |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 174        | 400           | 9.9 x10 <sup>-6</sup>                      |

#### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |          |           |
|------------|----------------|--|----------|-----------|
|            |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | COREAU V | ERITAS    |
| 256        | Room. Temp.    | 8.2 x10 <sup>-6</sup>                      | WWITNES! | 更与        |
|            |                | 1  | THE FATE | MITTEL. Y |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.  | SWI-FET-16   |  |
|-------------|--------------|--|
| Issued Date | 16.MAR.2011  |  |
| CHECKED BY  | ManJong,Ko   |  |
| APPROVED BY | Yongpyo, Cho |  |
| Page 5 of 6 |              |  |

#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 500           | 256        | Room. Temp.   | 9.2 x10 <sup>-6</sup>                      |

## - In this point, One Packing adjustment is taken for re-tightening.

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| Pres.(BAR) | Body Temp.(℃) | Packing leakage       | Packing torque |
|------------|---------------|-----------------------|----------------|
|            |               |                       | Nm             |
| 174        | 400           | 1.7 x10 <sup>-5</sup> | 39             |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |
|---------------|------------|----------------|--|
|               |            |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 500           | 174        | 400            | 2.2 x10 <sup>-5</sup>                      |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres.(BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |
|------------|---------------|--------------|--|
|            |               | leakage(ppm) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 256        | Room Temp.    | 37           | 1.5 x10 <sup>-5</sup>                      |

#### POST TEST EXAMINATION

No visible damage or wear on stem packing area



FORM-FET-01

SWI VALVE CO.LTD.



 REPORT.No.
 SWI-FET-16

 Issued Date
 16.MAR.2011

 CHECKED BY
 MANJONG,KO

 APPROVED BY
 YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

Page 6 of 6

#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS B                   |
|---------------------------|---------------------------|
| Body & bonnet gasket seal | ≤50 ppmv                  |
| Stuffing box stem seal    | ≤10⁴(mgxs⁻¹xm⁻¹)          |
|                           | Equivalent to             |
|                           | ≤5.6x10⁴(atm x cm³ x s⁻¹) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal : stem diameter 16 mm

|                        | CLASS B  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter( 0.016m ) xπx5.6x 10 <sup>-4</sup>                   |
|                        | (atm x cm <sup>3</sup> x s <sup>-1</sup> )                         |
|                        | = 2.8 x10 <sup>-5</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: BH** 

With one packing adjusted≤SSA1> for re tightening

### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 400 ℃

Performance class : ISO FE BH- CO2 - SSA1 - t- (400 ℃)-CL800- ISO 15848-1

SUNEAU VERITAS

CIRREVIEWED

MI WITNESSED

FOR HOME PROPERTY (2011)

TEST CHECKED BY: TEST APPROVED BY:

Man Jong , Ko

Yong Pyo, Cho

DATE: MAR 16<sup>TH</sup> , 2011

DATE: MAR 16<sup>TH</sup> , 2011





#### SWIValveCo., Ltd.

# **TEST/INSPECTION CERTIFICATE**

DATE: 2011.02.07

SWI ORDER NO.: SO2010100089

Healf office & Plant 1:1825-2 Gwanyang-dorry, Dongan-gu. Anyang-si Gyeonogi-do Korea Tel +82 31 421 1831~3 Fax +82 31 421 1831 Plant 2: 801-2 Goryeom-II, Cheunghuik myean, Pyeanqtaek-si, Gyeanggi da, Korea Tel +82 31 684 3981 - 3 Fax +82 31 684 2984 www.swiyolye.com

CERTIFICATE NO.

: 100089-4

PROJECT NAME / NO: Fugitive Emission Test Sample

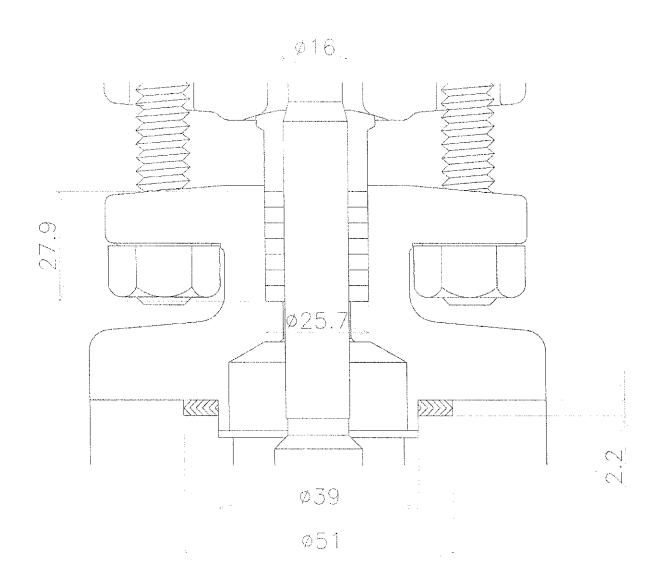
CUSTOMER/CLIENT: SWI Valve Co., Ltd.

PO NO.:

| TAG NO.  | ITEM DESCRIPTION                              | Class<br>Press<br>-ure  | SIZE<br>(inch)  | Q'ty     | Hydrostatic Test<br>(kg/cm²) |                    | Air Test<br>(kg/cm²) | Materials(ASTM)           |                     |          |                                | Dimen<br>-sion | Visual<br>Inspe  | Functi<br>-onal | Result      |
|--|---|-------------------------|-----------------|----------|------------------------------|--------------------|----------------------|---------------------------|---------------------|----------|--------------------------------|----------------|------------------|-----------------|-------------|
|  |   |                         |                 |          | Shell                        | Seat /<br>Backseat | Seat                 | Body &<br>Bonnet          | Seat Ring<br>(Seat) | Stem     | Wedge/ Disc<br>(Ball)          | Check          | -ction           | Test            |             |
| NOTE OF THE OWNER OWNER OF THE OWNER OWNE | GLOBE V/V RF                                  | 1500#                   | 1"              | 1        | 392                          | 289/289            | N/A                  | A105N                     | HF                  | A276-410 | A217-CA15/HF                   | GOOD           | GOOD             | GOOD            | ACCEPTE     |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          | V. V.A V. A.V. V               |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                |                  |                 |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                |                | LEVIE<br>SEVU    | VENT.           | 5           |
|  |   |                         |                 |          |                              |                    |                      |                           |                     |          |                                | 1 1            | । इस्राम्बर      | SSED            |             |
|  |   |                         | /***.//         |          |                              |                    |                      |                           |                     |          |                                |                | PARE             | on reason by    | 历沙          |
| ***************************************  |   |                         |                 |          |                              |                    |                      | ng secesive with a second |                     |          | , and any of the second second |                |                  |                 |             |
| Remarks  | These standard for ins     HF: STELLITE NO. 6 | spection of<br>Hard Fac | conform<br>cing | to API : | 598                          |                    |                      |                           |                     | Witne    | ssed / Reviewe                 | ed by Cu       | istomer          | Rep.            |             |
|  |   |                         |                 |          |                              |                    |                      |                           |                     | Q.A.M    | lanager                        | 797            | eme <sub>s</sub> | rese in         | <del></del> |

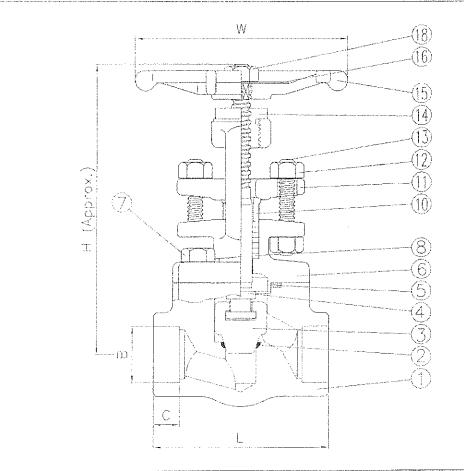
WE HEREBY CERTIFY THAT THE RESULTS MENTIONED ABOVE ARE TRUE AND CORRECT IN EVERY DETAIL





# GLOBE





| SIZE   | H      | Ι.   | W   | Port | . End Cor | nection | Weight | Q'TY   | Valve No.                                  |
|--------|--------|------|-----|------|-----------|---------|--------|--|--|
| (Inch) | (Open) | .4.4 | ,,  | Dia. | . В       | C .     | (Kg)   | (pcs)  |  |
| 1/4    | 152    | 86   | 102 | 6.4  | . 14.10   | 9.7     | 2.2    |  |  |
| 3/8    | 152    | 86   | 102 | 9.5  | 17.55     | 9.7     | 2.1    | 8  |  |
| 1/2    | 152    | 86   | 102 | 9.5  | 21.75     | 9.7     | 2.0    |  | HAU YERNAS                                 |
| 3/4    | 188    | 102  | 114 | 12.7 | 27.10     | 12.7    | 3.4    | i i wi   | TNESSED (                                  |
| 1      | 219    | 152  | 140 | 17.5 | 33.80     | 12.7    | 6.5    | 1132   | Collecte                                   |
| 1-1/4  | 260    | 172  | 165 | 22.5 | 42.55     | 12.7    | 9.7    | Samural de la composition della composition dell | All the construction of the State of South |
| 1-1/2  | 260    | 172  | 165 | 29.5 | 48.65     | 12.7    | 9.6    |  |  |
| ∦ o′   | 324    | 210  | 184 | 35.0 | 61.15     | 15.8    | 14.0   |  |  |

| B   | ILL OF        | MATERIALS               | )<br>)    |
|-----|---------------|-------------------------|-----------|
| NO. | PARIS         | MATERIALS               | ASTM      |
| 1   | Body          | Forged Steel            | A105      |
| 2   | Seat          | Stellite Hardlacing .   |           |
| 3   | Disc          | 13Cr Stainless Steel    | A217-CA15 |
| 4   | Stem          | 13Cr Stoinless Steel    | A276-410  |
| 5   | Gasket        | 304 Hoop + Grophite     |           |
| 6   | Bonnet        | Forged Steel            | A105      |
| 7   | Bonnet Bolt   | Alloy Steel             | A193-87   |
| 8   | Gland Packing | Graphite + Carbon Fiber |           |
| 10  | Gland         | Staintess Steet         | A276-316  |
| 11  | Gland Flonge  | Forged Steel            | A105      |
| 12  | Gland Nut     | Carbon Steel            | A194-2H   |
| 13  | Gland Bolt    | Alloy Steel             | A193-87   |
| 14  | Yoke Bush     | 130r Stainless Steel    | A27610    |
| 15  | Handwheel     | Molleable from          | A47       |
| 16  | Name Plate    | Alummum                 | •         |
| 18  | Handwheel Nut | Carbon Steet            | A194-2H   |
|     |               | •                       |           |

|                 | Shell                                   | :   | 5575  | PSI(  | 397   | - kg/H m/  |
|-----------------|---|---|---|---|---|--|
| Hydraulic Test  | Back Seat                               | :   | 4100  | Psi(  | 289   | Kg/Laif  |
|                 | Seat                                    | :   | 4100  | Psi(  | 289   | Kg/ Um²  |
| Seat of Body    | Hardfoce                                | d   | with Ste  | lile  | #6 on   | Body   |
| Disc            | Stellited                               | ď.  | (#6)  |   |   |  |
| Valve Finishing | Phosph                                  | ai  | tized   |   |   |  |
| End Connection  | Socket                                  | ٧   | /eld (A   | SME   | B16   | .11)   |
| 3               |   |   |   | ,   |   |  |
| 2               |   |   |   |   |   |  |
| 1               |   |   |   |   | *****   |  |
|                 | Seat of Body<br>Disc<br>Valve Finishing | Hydraulic Test Back Sectors Sectors Seat of Body Bordfoce Disc Stellited Valve Finishing Phosph | Hydraulic Test Bock Sect : Sect of Body Hordfoced Disc Stellifed Valve Finishing Phosphot | Hydraulic Test Bock Sect: 4100 Sect : 4100 Seat of Body Hardfoced with Ste Disc Stellited (#6) Valve Finishing Phosphatized | Hydraulic Test Back Sept : 4100 Psi( Sept : 4100 Psi( Sept of Body Bordfoced with Stellite Disc Stellited (#6) Valve Finishing Phosphatized | Seat of Body Hardfoced with Stellite #6 on Disc Stellited (#6) |

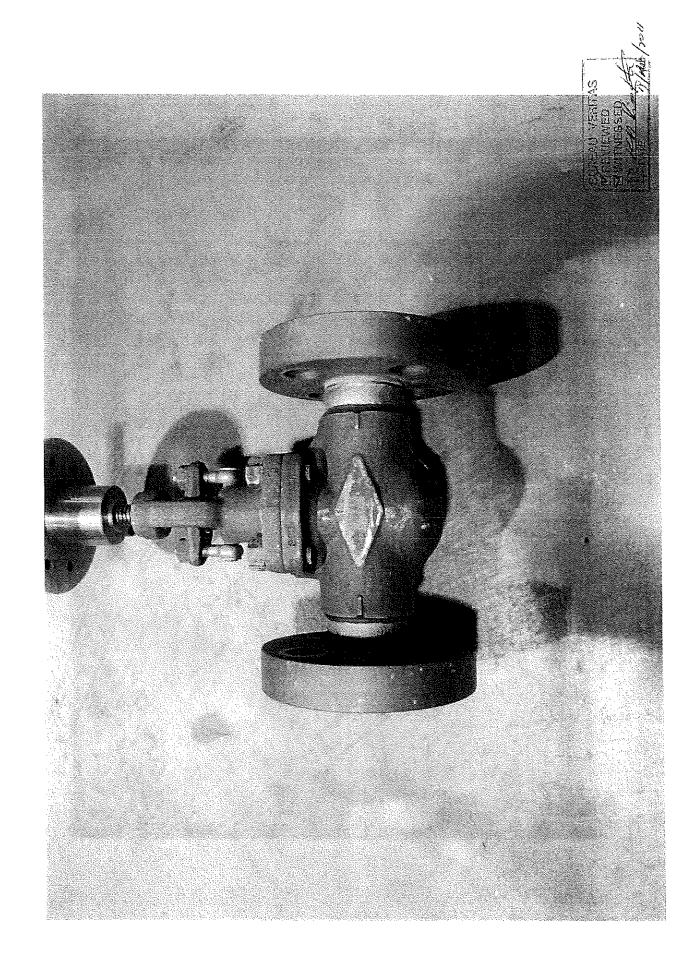
|   | Rev. | No. | <br>De | script |      | <br>(EA D     |  |
|---|------|-----|--------|--------|------|---------------|--|
| *************************************** |      |     |        | EL G   | LOBE | CLASS<br>PORT |  |

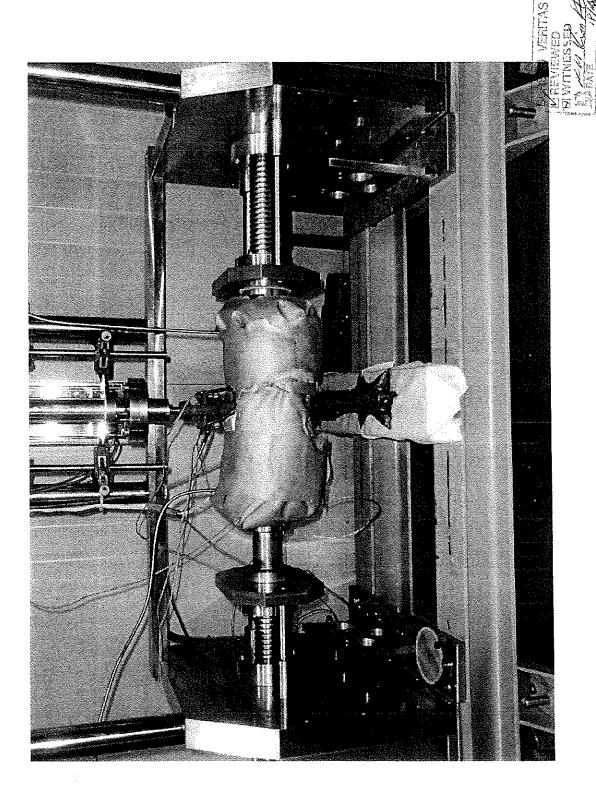
| -          | Refer to API 602 Fig No.:  | D.W.G. No. 11031961-02 |
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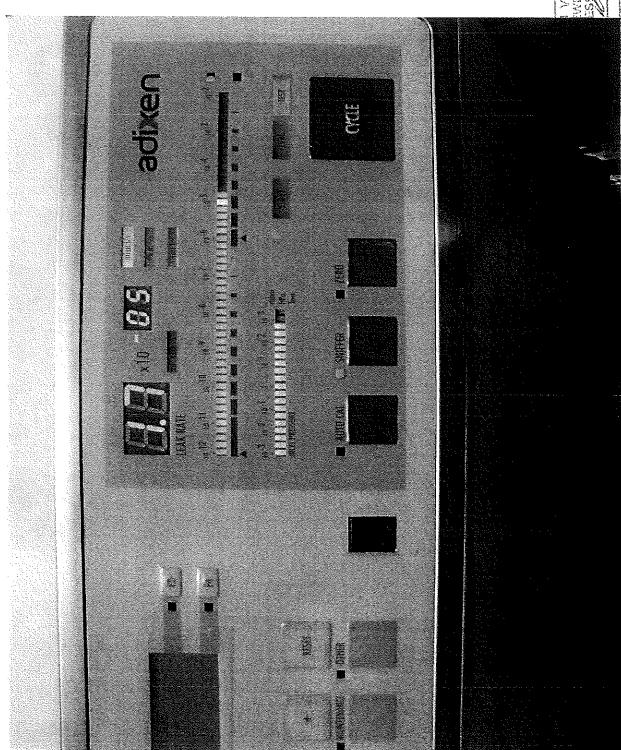
SW I Valve Co., Ltd.

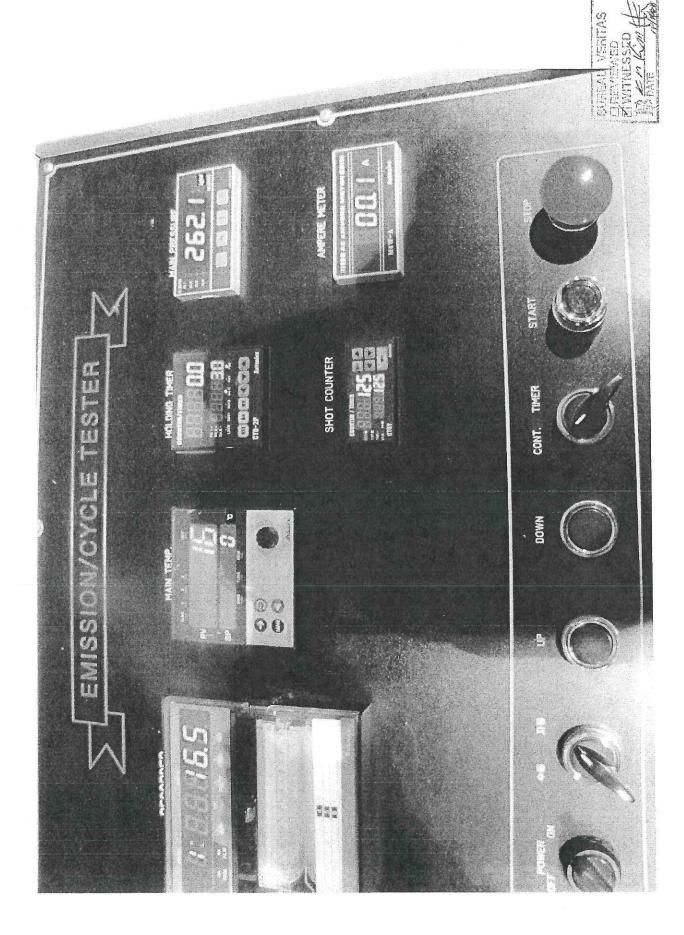
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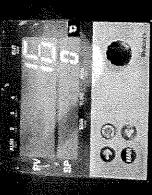






9.992

RECORDER



HOLDING TIMER

SHOT COUNTER

AMPERE METER



9

NMOO

5621 3

HOLDING TIMER COUNTRINGS 

( () () ()

SHOT COUNTER













NMOO

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# TYPE APPROVAL CERTIFICATE FOR BALL VALVE No. 940013/3-TC-05

| B.V. Job Ref :3,30,1030,03  |
|---|
| Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.   |
| #1023-2 Gwanyang 1-dong.Dongan-gu. Anyang-si, Gyeonggi-do, Korea  |
| Manufacturer : SWI Valve Co. Ltd., Korea  |
| 1) the addressee of the original of this certificate:   |
| Description of the Supply / Subject of Inspection: Product: Forged Steel Ball Valve Size of Tested Valve: 1" Material of Tested Valve: ASTM A105N Class of Tested Valve: #2500 Stem Diameter: 16.0 mm Fightness class: below 100ppm Endurance class: 1500cycles Femperature range: Room temperature to +200°C Packing Adjustment number: 0  |
| This certificate covers the whole of the supply: 🗵 YES (no more inspection planned) 🗀 NO (part of the supply still to be inspected)   |
| Scope of the B.V. Survey:  - Witness for Type Test of Fugitive Emission Test  This supply complies with the following applicable document (s): (2)  |
| - API 622 Type Testing of Process Valve Packing for Fugitive Emissions (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.  |
| List of enclosures: Test Report for Fugitive Emission Test 3 Pages  |
| (or reference to enclosed list) The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stumped, are considered as part of this certifical  |
| Marking and Stamping on the items: NONE  Particulars or comments:  This is to certify that the following valves have been inspected by Bureau Ventes and found to be satisfactory in The Fugitive Emission Test in accordance with API 622 First Edition, August 2006.  Date of Issuance: 24-Mar-2011   |
| Sign: OR Control of Inspection . BV-Korea. Secul Office   |
| This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas<br>Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Veritas   |
| This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal.  This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty guarantee, obligation and/or indemnity relating to, without limitation patents, workmanship, materials safety.  performance in operation and/or reliab by |

Ad ME 9813h



FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

| REPORT.No.  | SWI-FET-13  |  |  |  |  |
|-------------|-------------|--|--|--|--|
| Issued Date | 16.Mar.2011 |  |  |  |  |
| CHECKED BY  | ManJong,Ko  |  |  |  |  |
| APPROVED BY | Yongpyo,Cho |  |  |  |  |
| Page 1 of 3 |             |  |  |  |  |

# PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 21th Feb,2011 to 23th Feb,2011

### 1. VALVE SPECIFICATION

| Valve size & type  | 3-P BALL 2500# A105N/316+PEEK 1"" |
|--------------------|-----------------------------------|
| Material of Valve  | A105N                             |
| Valve class        | 2500#                             |
| Stem diameter      | 16.0 mm                           |
| Gland packing type | Graphite Molded Packing           |
| Packing material   | FKM+Graphite                      |
| Operating torque   | 139.6 N/m                         |
| Stroke/ Angle      | Quarter-turn                      |

### 2.TEST CONDITION

| Test pressure                 | 365-426 bar                                   |  |  |  |  |
|-------------------------------|---|--|--|--|--|
| Test medium                   | He 99%  |  |  |  |  |
| Check medium                  | He 99%  |  |  |  |  |
| Test temperature              | RT/ 200°C                                     |  |  |  |  |
| Test equipment                | Fugitive emission test equip. manufactured by |  |  |  |  |
|                               | SWI VALVE CO. LTD.                            |  |  |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |  |  |  |  |
| Sampling method               | Random  |  |  |  |  |
| Valve repacking before test   | 0   |  |  |  |  |
| Insulation of test valve      | Heating Jacket used SUMEAU VERIT              |  |  |  |  |
| Actuator                      | Geared motor DEVIEWED                         |  |  |  |  |

### A.1- Fugitive Emissions Test Report Summary

| API Std 622                       | Fugitive Emi                          | ssions Testing Report           | Number: SWI-FET-                  | 12                           |                                       |  |
|-----------------------------------|---------------------------------------|---------------------------------|-----------------------------------|------------------------------|---------------------------------------|--|
| Application Profile : C           |                                       | 100-1-1                         | mg*athhfules allow a Vender*arthu | Manufacturer: SW             |                                       |  |
|                                   | Rising                                |                                 |                                   | Description: 3-P B           | all A105N 2500# 1                     | "RF  |
| Testing Facility: SWI             | •                                     |                                 |                                   | Source: 🗹 Man                | ufacturer Date: 1                     | eTH const  |
| Technician: ManJong               |                                       |                                 |                                   | Source. Man                  |                                       | b rep <sub>i</sub> zoni                          |
| Witness: Ki-Man , Kir             |                                       | O LU DETH -                     |                                   |                              |                                       |  |
| Start date: 21 <sup>TH</sup> Feb, | 2011                                  | Completion: 23 <sup>TH</sup> Fe |                                   | Packaged:<br>Indicate New or | □ New                                 |  |
| Gland Load<br>Information psi.    |                                       | Gland Nut Torque : 3            | 39 ft-lbs                         | Current Product              | ☑ Current                             |  |
| Notes concerning ins              | tallation instructio                  | ns                              |                                   |                              | · · · · · · · · · · · · · · · · · · · |  |
|                                   |                                       |                                 |                                   |                              |                                       |  |
|                                   |                                       | Te                              | sting Profile Details             |                              |                                       |  |
|                                   | Leak                                  |                                 | Reference                         | Flats Adjusted-              | 0-6                                   |  |
| Test Segment                      | measurement<br>(500 ppm)              | Temperature(°C)                 | Temperature('C) at packing gland  | Gland Nut<br>Torque ft-lbs   | Reference A<br>Height (mm)            |  |
| . zer o vanioni                   | (500 ppini)<br>152                    |                                 |                                   | 39                           |                                       |  |
| Day1                              | 124                                   | Room temp.                      | Room temp.                        | 38                           | 44.50                                 | <del> </del>                                     |
| Start,Ambient                     | · · · · · · · · · · · · · · · · · · · | Room temp.                      | Room temp.                        |                              |                                       |  |
| 0-250 cycles                      | 134<br>164                            | Room temp.                      | Room temp.                        |                              |                                       |  |
|                                   |                                       | Room temp.                      | Room temp.                        |                              |                                       | <u> </u>   |
| P=426 (bar)                       | 154                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| Link Tanas                        | 167                                   | Room temp.                      | Room temp.                        | <b>1</b>                     |                                       |  |
| High Temperature                  | 202                                   | 200°C                           | 176°C                             |                              |                                       |  |
| 250-500cycles                     | 206                                   | 200°C                           | 176°C                             | -                            |                                       |  |
| P=365(bar)                        | 211                                   | 200°C                           | 176 C                             |                              |                                       |  |
| , ,                               | 234                                   | 200°C                           | 176 °C                            |                              |                                       |  |
|                                   | 227                                   | 200°C                           | 176℃                              |                              |                                       |  |
| Day2                              | 168                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| Ctart Ambiant                     | 194                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| Start,Ambient                     | 135                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| 500-750 cycles                    | 174                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| P≃426(bar)                        | 164                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
|                                   | 184                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| High Temperature                  | 233                                   | 200 °C                          | 176 °C                            | A                            |                                       | <u> </u>   |
| 750-1000 cycles                   | 206                                   | 200°C                           | 176°C                             |                              |                                       |  |
| -                                 | 211                                   | 200°C                           | 176°C                             |                              |                                       |  |
| P=365(bar)                        | 234                                   | 200°C                           | 176°C                             |                              |                                       |  |
|                                   | 227                                   | 200°C                           | 176°C                             |                              |                                       |  |
| Dave                              | 185                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| Day3                              | 164                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| Start,Ambient                     | 171                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| 1000-1250 cycles                  | 169                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| P=426(bar)                        | 170                                   | Room temp.                      | Room temp.                        |                              |                                       |  |
| 1 -420(001)                       | 180                                   | Room temp.                      | Room temp.                        |                              |                                       | THE PERSON NAMED IN THE PERSON NAMED IN COLUMN 1 |
| High Temperature                  | 190                                   | 200 °C                          | 176°C                             |                              | BUREAU                                | VERITAS  |
|                                   | 193                                   | 200 C                           | 176°C                             |                              | D REVIEW                              | SSED /   |
| 1250-1500cycles                   | 199                                   | 200°C                           | 176°C                             |                              | 10 10                                 | AL Zon E A                                       |
| P=365(bar)                        | 200                                   | 200°C                           | 176°C                             |                              | 10 DATE                               | warmen warmen and                                |
|                                   | 205                                   | 200°C                           | 176°C                             |                              |                                       |  |
|                                   |                                       | associated leak chec            |                                   |                              | <u> </u>                              |  |

| API Std 622                                  |   |
|--|---|
| Emissic                                      | ons Testing Report Summary  |
| Test Number: SWI-FET-10                      | Test Date: 21 <sup>TH</sup> to 23 <sup>TH</sup> Feb,2011  |
| Packing Material: FKM+ Graphite              | Style Number:   |
| Packing Manufacturer: PPE                    | Source of Sample: 3P BALL A105N/316+PEEK SW BC 2500# 1"   |
| Test Packing Cross-section: (circular)       | Laboratory Name: SWI LABORATORY   |
| o-ring / Rectangle                           | Location of Test: SWI FACTORY   |
| Packing Gland OD and ID(at the packing):     | Packing Gland Bolt Diameter= 12.7mm   |
| OD= 29  D= 23                                |   |
| Number of Mechanical Cycles: 750             | Packing Compression % of Free Height= 100 %   |
|  | Torque on Gland Nuts(each side)= 39/39 (ft-lbs)   |
| Number of Thermal Cycles: 750                | Mechanical Cycles Prior to Readjustment:  |
|  | Non-applicable  |
| Maximum Test Pressure : 426 bar              | Number of Readjustments: 0  |
| Packing Configuration: FKM + GRAPHITE        | Show Sketch of Packing Installation-define each ring:   |
| Number of rings tested: 3 Oring + 2 GRAPHITE | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\  |
| Circle the following                         |   |
| Ring shape(square, circular, vee)            |   |
| Solid or split                               |   |
| Braided                                      | - Contract of the contract of |
| Die formed                                   |   |
| Spool stock                                  |   |
| Wire or other reinforcement                  |   |
| Corrosion inhibitor &type                    |   |
| Other  |   |

| TEST CHECKED BY:                  | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| Man Jong , Ko                     | Yong Pyo, Cho                       |
| 7                                 | Y116                                |
| DATE: MAR 16 <sup>TH</sup> , 2011 | DATE: : MAR 16 <sup>TH</sup> , 2011 |





# TYPE APPROVAL CERTIFICATE FOR BALL VALVE No. 940013/3-TC-06

| 140. 3400 13/3-1 C-00   |
|---|
| B.V. Job Ref :3.30.1030.03<br>Inspection ordered to B.V. by (1) : SWI Valve Co. Ltd.  |
|   |
| #1023-2 Gwanyang 1-dong,Dongan-gu, Anyang-si, Gyeonggi-do. Korea  |
| Manufacturer : SWI Valve Co. Ltd., Korea  |
| (1) the addresses of the original of this cerificate;   |
| Description of the Supply / Subject of Inspection:  Product: Forged Steel Ball Valve  Size of Tested Valve: 1"  Material of Tested Valve: ASTM A105N  Class of Tested Valve: #2500  Stem Diameter: 16.0 mm  Tightness class: AH  Endurance class: CO2(1500cycles)  Temperature class: 1200°C  Valves Qualified according to sizes: up to 2" (Stem Dia.: 8.0 to 32.0 mm)  Valves Qualified according to pressure ratings: #150, #300, #600; #800, #1500, #2500  Valves Qualified according to tightness class: AH  Valves Qualified according to Endurance class: CO2(1500cycles)  Valves Qualified according to temperature class: Room temperature to +200°C  This certificate covers the whole of the supply: YES (no more inspection planned) NO (part of the supply still to be inspected)  Scope of the B.V. Survey:  - Witness for Type Test of Fugitive Emission Test  This supply compties with the following applicable document (s): (2)  - ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission |
| (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.   |
| List of enclosures: Test Report for Fugitive Emission Test 6 Pages  |
| (or reference to enclosed list) The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.  |
| Marking and Stamping on the items: NONE   |
| Marking and Stamping on the items: NONE  Particulars or comments: This is to certify that the following valves have been inspected by Bureau Veritae and found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006.  Date of Issuance: 24-Mar-2011   |
| Sign: O N Location of inspection: BV-Korea, Seoul Office  |
| This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas.<br>Ce Certificat est déliviré dans le cadre des Conditions Générales de Service du Bureau Veritas.  |
| This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal.  This certificate is NOT an indication that the item(s) is (are) fit for any specific curpose and does not release the manufacturer, supplier and any party from their respective duty guarantee obligation and/or indemnity relating to without limitation, patents workmanship materials safety, performance in operation and/or releability.  |

Ad ME 96131



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT, No. | SWI-FET-12   |
|-------------|--------------|
| Issued Date | 16. MAR.2011 |
| CHECKED BY  | ManJong, Ko  |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

Page 1 of 6

## PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 21th Feb,2011 to 22th Feb,2011

### 1. VALVE SPECIFICATION

| Valve size & type  | 3-P BALL 2500# A105N/316+PEEK 1" |  |
|--------------------|----------------------------------|--|
| Material of Valve  | A105N                            |  |
| Valve class        | 2500#                            |  |
| Stem diameter      | 16.0 mm                          |  |
| Gland packing type | Graphite Molded Packing          |  |
| Packing material   | FKM+Graphite                     |  |
| Operating torque   | 139.6 N/m                        |  |
| Stroke/ Angle      | Quarter-turn                     |  |

### 2. TEST CONDITION

| Test pressure                 | 365-426 bar                                   |                        |
|-------------------------------|---|------------------------|
| Test medium                   | He 99%  |                        |
| Check medium                  | He 99%  |                        |
| Test temperature              | RT/ 200℃                                      |                        |
| Test equipment                | Fugitive emission test equip, manufactured by |                        |
|                               | SWI VALVE CO. LTD.                            |                        |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |                        |
| Sampling method               | Random  |                        |
| Valve repacking before test   | 0   |                        |
| Insulation of test valve      | Heating Jacket used                           | BUREAU VERITAS         |
| Actuator                      | Geared motor                                  | REVIEWED<br>MWITNESSED |



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT,No.  | SWI-FET-12   |
|-------------|--------------|
| Issued Date | 16. MAR.2011 |
| CHECKED BY  | ManJong,Ko   |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

Page 2 of 6

### 3. CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4  |
|---|--|
| Number of cycles for step                 | 125  |
| Number of step test cycles                | 2  |
| Number of cycles for step                 | 500  |
| Number of step cycles at high temperature | 3  |
| The duration of the cycle stroke          | 14sec. (open 4sec. +stem movement 4sec.+close 4sec.) |

### 4. DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

### 5. TEST RESULTS

Test results are recorded in manufactures test report from next page.

BUREAU VERITAS

DEVIEWED

WITNESSED

DOTE



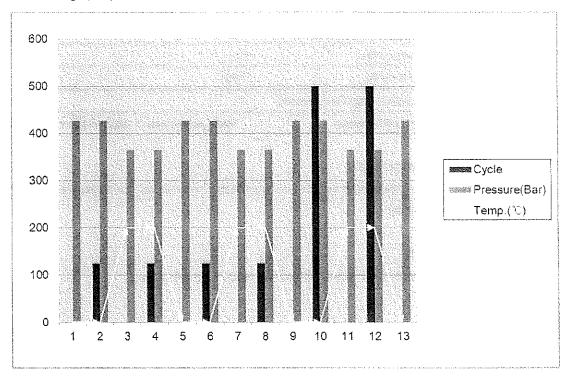
### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| 1 | REPORT, No. | SWI-FET-12   |
|---|-------------|--------------|
|   | ISSUED DATE | 16. MAR.2011 |
|   | CHECKED BY  | ManJong,Ko   |
|   | APPROVED BY | Yongpyo,Cho  |
|   |             |              |

Page 3 of 6

### 6. TEST STEPS

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



### STEP

### 7. TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

TEST FROM ROOM TEMPERATURE TO +200°C



### Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |
|-------------|---------------|--------------|--|
|             |               | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 426         | Room. Temp.   | 0            | 1.0 x 10 <sup>-7</sup>                     |

### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 426         | Room, Temp.   | 1.3x10 <sup>-7</sup>                       |

FORM-FET-01 SWI VALVE CO.LTD.



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| Report.No.  | SWI-FET-12   |
|-------------|--------------|
| Issued Date | 16. MAR.2011 |
| CHECKED BY  | ManJong,Ko   |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

Page 4 of 6

### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200℃

| Pres. (BAR) | Body Temp.(℃) Packing leaka |  |
|-------------|-----------------------------|--|
|             |                             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 365         | 200                         | 1.2 x 10 <sup>-7</sup>                     |

### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200℃

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 365         | 200           | 1.8 x10 <sup>-7</sup>                      |

### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|-------------|---------------|--|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 426         | Room, Temp.   | 1.7 ×10 <sup>-7</sup>                      |

### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(°C) | Packing leakage                            |
|---------------|-------------|----------------|--|
|               |             |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 426         | Room. Temp.    | 1.6 x10 <sup>-7</sup>                      |

### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200℃

| Pres. (BAR) | Body Temp.(°C) | Packing leakage                            |  |
|-------------|----------------|--|--|
|             |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |
| 365         | 200            | 1.9 x10 <sup>-7</sup>                      |  |

### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200 °C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage       |
|---------------|-------------|---------------|-----------------------|
|               |             |               | (atm x cm³ x s⁻¹)     |
| 125           | 365         | 200           | 2.3 x10 <sup>-7</sup> |

### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            | كو يكون المنافع المنافع المنافع المنافع المنافعة المنافعة المنافعة المنافعة المنافعة المنافعة المنافعة المنافعة |
|-------------|---------------|--|---|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | GURGAU VERITAS  |
| 426         | Room. Temp.   | 2.1 x10 <sup>-7</sup>                      | WITNESSED H   |
|             |               |  | DIP DATE 1/ Tiel in   |



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| _ |             |              |
|---|-------------|--------------|
|   | REPORT.No.  | SWI-FET-12   |
|   | Issued Date | 16. MAR.2011 |
|   | Снескер Ву  | ManJong,Ko   |
|   | Approved By | Yongpyo,Cho  |
|   |             |              |

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### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                             |
|---------------|-------------|---------------|---|
|               |             |               | ((atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 500           | 426         | Room. Temp.   | 2.0 x10 <sup>-7</sup>                       |

### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200°C

| Pres. (BAR) | Body Temp.(℃) | Packing leakage(atm x cm³ x s⁻¹) |
|-------------|---------------|----------------------------------|
| 365         | 200           | 2.6 x10 <sup>-7</sup>            |

### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200 ℃

| No. of Cycles | Pres. (BAR) | Body Temp.( °C) | Packing leakage       |
|---------------|-------------|-----------------|-----------------------|
|               |             |                 | (atm x cm³ x s⁻¹)     |
| 500           | 365         | 200             | 2.5 x10 <sup>-7</sup> |

### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage       |
|-------------|---------------|--------------|-----------------------|
|             |               | leakage(PPM) | (atm x cm³ x s⁻¹)     |
| 426         | Room Temp.    | 15           | 1.9 x10 <sup>-7</sup> |

### POST TEST EXAMINATION

No visible damage and wear on stem packing area



FORM-FET-01

SWI VALVE CO.LTD.



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No.  | SWI-FET-12   |
|-------------|--------------|
| ISSUED DATE | 16. MAR.2011 |
| CHECKED BY  | ManJong, Ko  |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

Page 6 of 6

### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS A  |
|---------------------------|--|
| Body & bonnet gasket seal | ≤50 ppmv   |
| Stuffing box stem seal    | ≤10 <sup>-8</sup> (mgxs <sup>-1</sup> xm <sup>-1</sup> )         |
|                           | Equivalent to  |
|                           | ≤5.6x10 <sup>-s</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

stuffing box packing seal : stem diameter 16.0 mm

|                        | CLASS A  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter( 0.016m )x5.6x 10 <sup>-6</sup>                      |
|                        | (atm x cm³ x s¹)   |
|                        | = 2.8 x10 <sup>-7</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: AH** 

With no packing adjusted≤SSA0> for re tightening

### **ENDURANCE CLASS:**

CO2 1,500 cycles

### **TEMPERAUTRE CLASS:**

Room temperature to 200 ℃

Performance class : ISO FE AH- CO2 - SSA0 - t- (200 ℃)-CL600- ISO 15848-1

UNEAU VERITAS
DEVIEWED
BYTTNESSED
BOATE

TEST CHECKED BY:

Man Jong , Ko

Yong Pyo, Cho

DATE: MAR 16<sup>TH</sup> , 2011

DATE: MAR 16<sup>TH</sup> , 2011





### SWI Valve Co., Ltd.

### **TEST/INSPECTION CERTIFICATE**

DATE: 2011.02.16

SWI ORDER NO.: SO2010100089

Head office & Plant 1:1023-2 Gwanyang dong Dongan-gu, Augung st, Gyeonggi-da, Kousa Tel +82.31 421 1831—3 Fax +82.31 421 1834 Plant 2: 801-2 Garyenm vi, Oreonysbuk-myesia, Pyronyssek-si, Gyrongg: da Korea Tel +82 31 684 2981 - 3 Tax +92 31 684 2984 www.com/abe.com

CERTIFICATE NO.

PROJECT NAME / NO: Fugitive Emission Test Sample

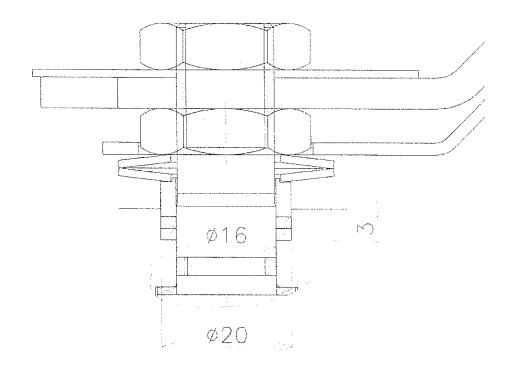
CUSTOMER/CLIENT : SWI Valve Co., Ltd.

PO NO.:

| ITEM DESCRIPTION                                    | Class                                  | SIZE              | Q'ty  | (kg   | /cm²)                                 | Air Test<br>(kg/cm²)   |                                  | Materials   | (ASTIVI)  |   |   | Visual Functi  | -onal Resul  | Recult   |
|---|--|-------------------|---|---|---------------------------------------|--|----------------------------------|---|---|---|---|--|--|--|
| FEM DESCRIPTION                                     | -ure                                   | (inch)            | G Ly  | Shell   | Seat /<br>Backseat                    | Seat   | Body &<br>Bonnet                 | Seat Ring<br>(Seat)   | Stem  | Wedge/ Disc<br>(Ball)                         |   | -ction   |  | resuit   |
| BALL V/V RF   | 2500#                                  | 1"                | 1   | 657   | N,A                                   | 7  | A105N                            | PEEK  | A276-316  | A276-316                                      | GOOD  | GOOD   | GOOD   | ACCEPTE  |
|   |  |                   |   |   |                                       |  |                                  |   |   |   |   |  |  |  |
|   |  |                   |   | anne i landratika i atlanto, aa ad  |                                       |  |                                  |   |   |   | THE PLANE STATE OF THE BOOK OF THE STATE OF | AMARIA III III NOTA  |  | J  |
|   |  |                   |   |   |                                       |  |                                  |   |   |   |   |  |  |  |
|   |  |                   |   |   |                                       |  |                                  | ·   |   |   |   |  |  |  |
|   |  |                   |   |   |                                       |  |                                  |   |   |   |   |  |  |  |
|   |  |                   |   |   |                                       |  |                                  |   |   |   |   |  | 5  |  |
|   |  |                   |   |   |                                       |  |                                  |   |   |   |   |  |  |  |
|   |  |                   | NAME OF THE OWNER, |   |                                       | <b>§</b>   |                                  |   |   |   |   |  |  |  |
|   |  |                   | ->->-   |   |                                       |  |                                  |   |   |   |   |  |  |  |
|   |  |                   |   | <del></del>   | · · · · · · · · · · · · · · · · · · · |  |                                  |   |   |   |   |  |  |  |
| 1. These standard for ins<br>2. HF : STELLITE NO. 6 | pection of<br>Hard Fac                 | onform<br>cing    | to API  | 598   |                                       | NA SOCIAL DE LA CASA D | DREVIEW<br>DWITNES<br>DREET      | VERTIAS<br>VED<br>SSEQ<br>1-1774  |   |   |   |  |  | 200 E 20   |
|   | BALL V/V RF  1. These standard for ins | BALL V/V RF 2500# | BALL V/V RF 2500# 1"  | BALL V/V RF 2500# 1" 1  1. These standard for inspection conform to API 5 | BALL V/V RF 2500# 1" 1 657            | BALL V/V RF 2500# 1" 1 657 N.A  1. These standard for inspection conform to API 598  | BALL V/V RF 2500# 1" 1 657 N.A 7 | BALL V/V RF 2500# 1" 1 657 N.A 7 A105N  BALL V/V RF 2500# 1" 1 657 N.A 7 A105N  1. These standard for inspection conform to API 598 | BALL V/V RF 2500# 1" 1 657 N.A 7 A105N PEEK  BALL V/V RF 2500# 1" 1 657 N.A 7 A105N PEEK  1. These standard for inspection conform to API 598 | Shell   Seat   Body & Seat Ring (Seat)   Stem | Shell   Shell   Seat   Body & Seat Ring (Seat)   Stem   Wedgel Disc (Ball)  | Shell   Seat   Seat   Body & Seat Ring   Stem   Wedge/ Disc   Check   (Ball) | Shell   Seat   Seat   Body & Seat   Seat   Body & Seat   Seat   Body & Seat   Seat | Shell   Seat   Seat   Body & Seat   Body & Seat   Seat   Body & Seat   Seat |

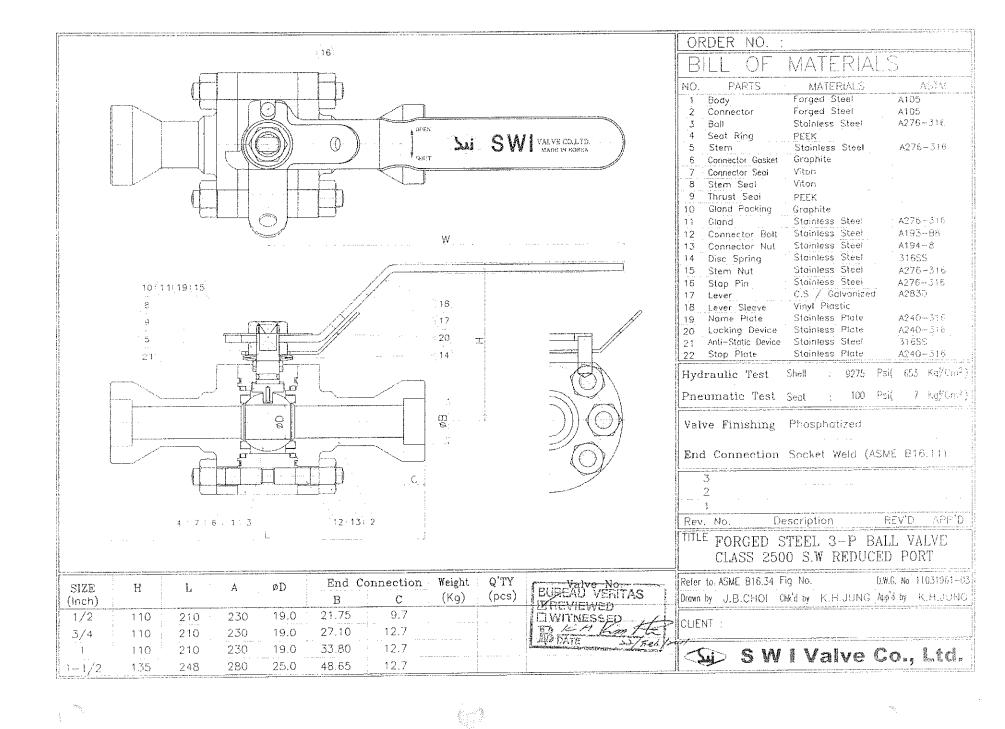
SWI-FORM QA-013

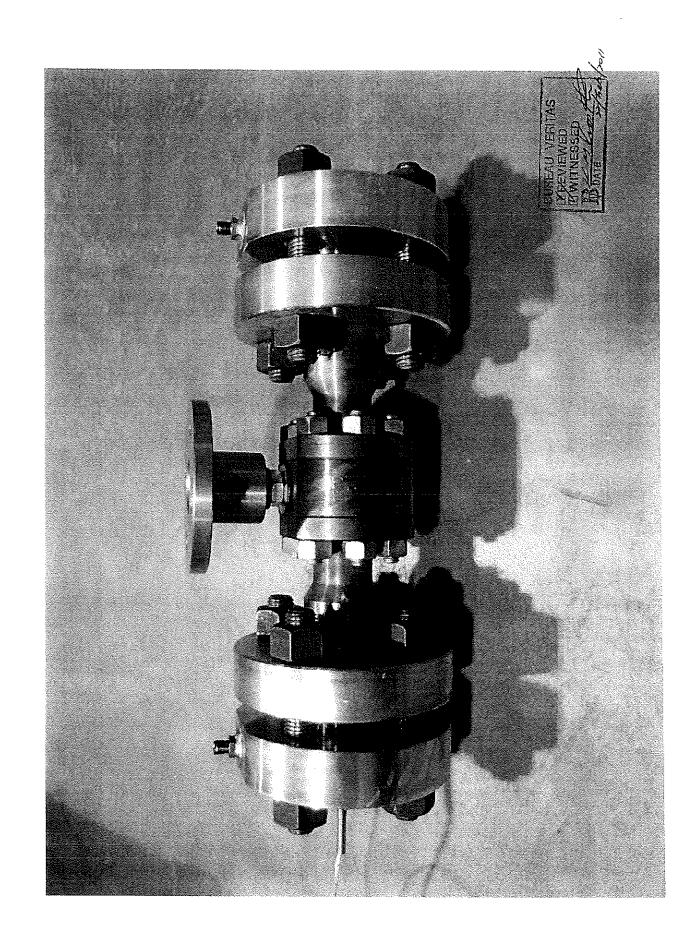
1 of 1

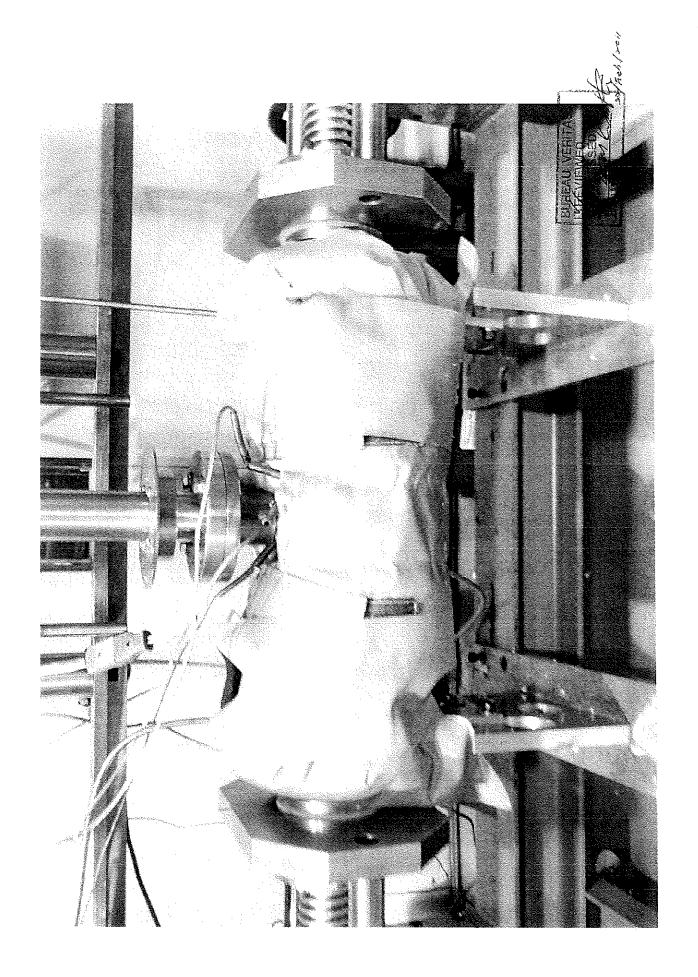


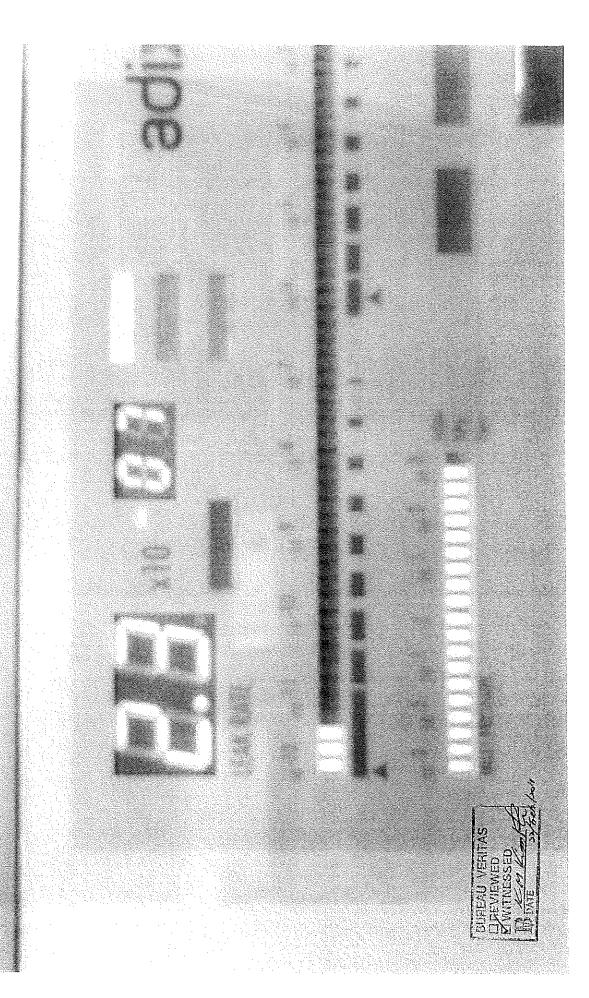


# BALL











i neggari



# 作品 しい しょうくう とうこうのう 下

MAIN TEMP.



HOLDING TIMER



MAIN PRESSURE

AMPERE METER



SHOT COUNTER





Energy & Process

# TYPE APPROVAL CERTIFICATE FOR BALL VALVE No. 940013/3-TC-07

| B.V. Job Ref :3.30.1030.03  | TO THE STATE OF TH |
|---|--|
| Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.   |  |
| #1023-2 Gwanyang 1-dong Dongan-gu, Anyang-si, Gyeongg   | gi-do, Korea   |
| Manufacturer : SWI Valve Co. Ltd., Korea  |  |
| (1) the addressee of the original of this certificate;  |  |
| Description of the Supply / Subject of inspection : Product : Casting Ball Valve Size of Tested Valve : 2" Material of Tested Valve : ASTM A216 WCB Class of Tested Valve : #300 Stem Diameter : 25.0 mm Tightness class : below 100ppm Endurance class : 1500cycles Temperature range : Room temperature to +200°C Packing Adjustment number : 0   |  |
| This certificate covers the whole of the supply: 🗵 YES (no more inspection planned) 📋 NO (part of the supply still  | to be inspected)   |
| Scope of the B.V. Survey:   |  |
| - Witness for Type Test of Fugitive Emission Test   |  |
| - API 622 Type Testing of Process Valve Packing for Fugitive Emissions (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau  List of enclosures: Test Report for Fugitive Emission Test 3 Pages (or reference to enclosed list)   |  |
| The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered.  | lered as part of this certifica  |
| Marking and Stamping on the items: NONE   |  |
| Particulars or comments: This is to certify that the following valves have been inspected by Eurapu veritas and found to The Fugitive Emission Test in accordance with API 622 First Edition, Aboust 2006.  Date of Issuance: 24-Mar-2011   Issued by Date of last inspection: 15 to 17-Feb-2011 Name: K. M. Kima Foul L.  Sign:  Location of inspection: BV-Korea, Seoul Office  | o be satisfactory in   |
| This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas<br>Ce Certificat est déliviré dans le cadre des Conditions Générales de Service du Bureau Veritas  |  |
| This confincate is issued further to an insportion whose duration and scope were limited by the terms and concitions of the contract with BV principal. This certificate is NOT an indication (hall the item(s) is (are) fit for any specific purpose and does not release the menufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indentity felating to, without limitation patterns, workmanship, materials, safety, cerformance in operation and/or reliability. |  |

Ad ME 98136



FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

| Ì | REPORT.No.  | SWI-FET-11  |
|---|-------------|-------------|
|   | Issued Date | 16.Mar.2011 |
|   | CHECKED BY  | ManJong.Ko  |
|   | APPROVED BY | Yongpyo,Cho |
|   | Pa          | ige 1 of 3  |

# PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer : SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 15<sup>th</sup> Feb,2011 to 17<sup>th</sup> Feb,2011

### 1. VALVE SPECIFICATION

| Valve size & type  | 2P-BALL VALVE WCB/316+RTFE RF FB |
|--------------------|----------------------------------|
|                    | 300# 2"                          |
| Material of Valve  | A216-WCB                         |
| Valve class        | 300#                             |
| Stem diameter      | 25.0 mm                          |
| Gland packing type | Graphite Molded Packing          |
| Packing material   | FKM+Graphite                     |
| Operating torque   | 54N/m                            |
| Stroke/ Angle      | Quarter-turn                     |

### 2. TEST CONDITION

| Test pressure                 | 44 - 52 bar                                   |  |  |
|-------------------------------|---|--|--|
| Test medium                   | He 99%  |  |  |
| Check medium                  | He 99%  |  |  |
| Test temperature              | RT/ 200°C                                     |  |  |
| Test equipment                | Fugitive emission test equip, manufactured by |  |  |
|                               | SWI VALVE CO. LTD.                            |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |  |  |
| Sampling method               | Random  |  |  |
| Valve repacking before test   | 0 EUSEAU V                                    |  |  |
| Insulation of test valve      | Heating Jacket used DBEVIEW                   |  |  |
| Actuator                      | Geared motor TO KA                            |  |  |

### A.1- Fugitive Emissions Test Report Summary

| pplication Profile : 0                  | Check One             |                              |   | Manufacturer: SW                   | I VALVE CO, LTD | · · · · · · · · · · · · · · · · · · · |
|---|-----------------------|------------------------------|---|------------------------------------|-----------------|---------------------------------------|
|   | Rising                |                              |   | Description: 2-P B                 | all WCB 300# 2" |                                       |
| esting Facility: SWI                    | Factory               |                              |   |                                    |                 | lia.                                  |
| echnician: Man-Jon                      | =                     |                              | Source: Manufacturer Date: 7th Feb,2011 |                                    |                 |                                       |
| Vitness: Ki-Man , Kir                   |                       |                              |   |                                    | (HDUIO)         |                                       |
| tart date: 15 <sup>TH</sup> Fet         | 3,2011<br>            | Completion: 17 <sup>TH</sup> | Feb,2011                                | Packaged:                          | CT Now          |                                       |
| Sland Load                              |                       | Gland Nut Torque :           | 39 ft-lbs                               | Indicate New or<br>Current Product | New     Current |                                       |
| nformation pst.<br>Lotes concerning ins | tallation instruction | ns                           |   |                                    |                 |                                       |
| NI SANGA                                |                       |                              |   |                                    |                 |                                       |
|   | Leak                  | le                           | sting Profile Details Reference         | Flats Adjusted-                    |                 |                                       |
|   | measurement           |                              | Temperature(°C)                         | Gland Nut                          | Reference A     |                                       |
| Test Segment                            | (500 ppm)             | Temperature(°C)              | at packing gland                        | Torque ft-lbs                      | Height (mm)     |                                       |
| Day1                                    | 0                     | Room temp.                   | Room temp.                              | 39                                 | 44.50           |                                       |
|   | 0                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| Start,Ambient                           | 0                     | Room temp.                   | Room temp,                              |                                    |                 |                                       |
| 0-250 cycles                            | 0                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| P=52 (bar)                              | 0                     | Room temp,                   | Room temp.                              |                                    |                 |                                       |
| , = ,                                   | 0                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| High Temperature                        | 0                     | 200°C                        | 176°C                                   |                                    |                 |                                       |
| 250-500cycles                           | 0                     | 200°C                        | 176°C                                   |                                    |                 |                                       |
| P=44(bar)                               | 0                     | 200°C                        | 176°C                                   |                                    |                 |                                       |
|   | 1                     | 200°C                        | 176°C                                   |                                    |                 |                                       |
|   | 2                     | 200°C                        | 176°C                                   |                                    |                 |                                       |
| 56                                      | 0                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| Day2                                    | 0                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| Start,Ambient                           | 2                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| 500-750 cycles                          | 3                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| P=52(bar)                               | 3                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| 1 -02(041)                              | 5                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| High Temperature                        | 12                    | 200°C                        | 176°C                                   |                                    |                 |                                       |
| 750-1000 cycles                         | 13                    | 200°C                        | 176°C                                   |                                    |                 |                                       |
| •                                       | 15                    | 200℃                         | 176°C                                   |                                    |                 |                                       |
| P=44(bar)                               | 15                    | 200°C                        | 176°C                                   |                                    |                 |                                       |
|   | 16                    | 200 °C                       | 176°C                                   |                                    |                 |                                       |
|   | 8                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| Day3                                    | 9                     | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| Start,Amblent                           | 10                    | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| 1000-1250 cycles                        | 11                    | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| P=52(bar)                               | 11                    | Room temp.                   | Room temp.                              |                                    |                 |                                       |
| i -ozinai)                              | 12                    | Room temp.                   | Room temp.                              |                                    | ,               | DEAU VERITA                           |
| High Temperature                        | 15                    | 200°C                        | 176°C                                   |                                    | 300             | REVIEWED                              |
| ,                                       | 16                    | 200°C                        | 176°C                                   |                                    |                 | WITNESSED                             |
| 1250-1500cycles                         | 18                    | 200℃                         | 176°C                                   |                                    | 80 (1)          | ATE KIND                              |
| P=44(bar)                               | 18                    | 200°C                        | 176°C                                   |                                    | - And           |                                       |
|   | 23                    | 200°C                        | 176°C                                   | <del> </del>                       |                 | <del></del>                           |

| API Std 622  |  |
|--|--|
| Emíssion   | ns Testing Report Summary                                |
| Test Number: SWI-FET-11  | Test Date: 15 <sup>TH</sup> to 17 <sup>TH</sup> Feb,2011 |
| Packing Material: FKM+ Graphite  | Style Number:  |
| Packing Manufacturer: PPE  | Source of Sample: 2-P BALL WCB/316+RTFE  RF FB 300# 2"   |
| Test Packing Cross-section: (circular)   | Laboratory Name: SWI LABORATORY                          |
| o-ring / Rectangle   | Location of Test: SWI FACTORY                            |
| Packing Gland OD and ID(at the packing):   | Packing Gland Bolt Diameter= 12.7mm                      |
| OD= 34.6   |  |
| Number of Mechanical Cycles: 750   | Packing Compression % of Free Height= 100 %              |
|  | Torque on Gland Nuts(each side)= 39/ 39 (ft-lbs)         |
| Number of Thermal Cycles: 750  | Mechanical Cycles Prior to Readjustment:                 |
| PAN SENSENSE SENSE SENSENSE SENSENSE SENSENSE SENSENSE SENSENSE SENSENSE SE | Non-applicable   |
| Maximum Test Pressure : 52 bar   | Number of Readjustments: 0                               |
| Packing Configuration: FKM + GRAPHITE  | Show Sketch of Packing Installation-define each ring:    |
| Number of rings tested: 3 Oring + 2 GRAPHITE   | <del>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</del>         |
| Circle the following   |  |
| Ring shape(square, circular, vee)  |  |
| Solid ar split   |  |
| Braided  |  |
| Die formed   |  |
| Spool stock  |  |
| Wire or other reinforcement  |  |
| Corrosion inhibitor &type Other  |  |

| TEST CHECKED BY:                  | TEST APPROVED BY :                  |
|-----------------------------------|-------------------------------------|
| Man Jong , Ko                     | Yong Pyo, Cho                       |
| 7                                 | 1110                                |
| DATE: MAR 16 <sup>TH</sup> , 2011 | DATE: : MAR 16 <sup>TH</sup> , 2011 |



### TYPE APPROVAL CERTIFICATE FOR FLOATING BALL VALVE No. 940013/3-TC-08

B.V. Job Ref: 3.30,1030,03

Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.

#1023-2 Gwanyang 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea

Manufacturer : SWI Valve Co. Ltd., Korea

(1) the addressee of the original of this certificate

Description of the Supply / Subject of inspection:

Product: Casting Ball Valve

Size of Tested Valve: 2"

Material of Tested Valve : ASTM A216 WCB

Class of Tested Valve: #300 Stem Diameter: 25,0 mm Tightness class: AH

Endurance class : CO2(1500cycles)

Temperature class: t200°C

Valves Qualified according to sizes : up to 8" (Stem Dia. : 12.5 to 50.0 mm)

Valves Qualified according to pressure ratings: #150, #300

Valves Qualified according to tightness class: AH

Valves Qualified according to Endurance class: CO2(1500cycles)

Valves Qualified according to temperature class: Room temperature to +200°C

This certificate covers the whole of the supply 🗵 YES (no more inspection planned) 🗌 NO (part of the supply still to be inspected)

### Scope of the B.V. Survey:

- Witness for Type Test of Fugitive Emission Test

This supply complies with the following applicable document (s): (2)

- ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.

List of enclosures: Test Report for Fugitive Emission Test ----- 6 Pages

(or reference to enclosed list)

The certificate is valid logethar with enclosures (if listed). Only pages of enclosures (or paris of pages) which are stamped, are considered as port of this certificate

ad to be satisfactory in

SEOUL

Marking and Stamping on the items: NONE

Particulars or comments:

This is to certify that the following valves have been inspected by Burgary

The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006

Date of Issuance: 24-Mar-2011

Issued by

Date of last inspection: 16 to 17-Feb-2011 Name: K. M. Kim

Sign:

Location of inspection : BV-Korea, Seoul Office

This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est délivre dans le cadre des Conditions Générales de Service du Bureau Veritas

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal this certificate is NOT an indication that the time (s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee obligation and/or indimnity relating to, without limitation, palents workmanship, materials, safety. parformance in operation and/or reliability

Ac ME 9813b



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No. |             | SWI-FET-10   |
|------------|-------------|--------------|
|            | ISSUED DATE | 16. MAR.2011 |
|            | CHECKED BY  | ManJong, Ko  |
| ĺ          | APPROVED BY | Yongpyo,Cho  |
|            |             |              |

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### PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 16<sup>th</sup> Feb,2011 to 17<sup>th</sup> Feb,2011

### 1. VALVE SPECIFICATION

| Valve size & type  | 2-P BALL 300# WCB/316+RTFE RF FB 2" |
|--------------------|-------------------------------------|
| Material of Valve  | A216 WCB                            |
| Valve class        | 300#                                |
| Stem diameter      | 25.0 mm                             |
| Gland packing type | Graphite Molded Packing             |
| Packing material   | FKM+Graphite                        |
| Operating torque   | 54N/m                               |
| Stroke/ Angle      | Quarter-turn                        |

### 2. TEST CONDITION

| E. ILOI OSHBIRION             |   |              |  |  |
|-------------------------------|---|--------------|--|--|
| Test pressure                 | 44-52 bar                                     |              |  |  |
| Test medium                   | He 99%  |              |  |  |
| Check medium                  | He 99%  |              |  |  |
| Test temperature              | RT/ 200℃                                      |              |  |  |
| Test equipment                | Fugitive emission test equip. manufactured by |              |  |  |
|                               | SWI VALVE CO. LTD.                            |              |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |              |  |  |
| Sampling method               | Random  |              |  |  |
| Valve repacking before test   | 0   |              |  |  |
| Insulation of test valve      | Heating Jacket used                           | BUREAU VERIT |  |  |
| Actuator                      | Geared motor                                  | WITNESSED    |  |  |



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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|-------------|--------------|--|
| ISSUED DATE | 16. MAR.2011 |  |
| CHECKED BY  | ManJong,Ko   |  |
| APPROVED BY | Yongpyo,Cho  |  |
|             |              |  |

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### 3. CONDITION FOR CYCLING TEST

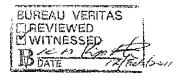
| Number of step test cycles                | 4  |
|---|--|
| Number of cycles for step                 | 125  |
| Number of step test cycles                | 2  |
| Number of cycles for step                 | 500  |
| Number of step cycles at high temperature | 3  |
| The duration of the cycle stroke          | 12sec. (open 5sec. +stem movement 2sec.+close 5sec.) |

### 4. DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

### 5. TEST RESULTS

Test results are recorded in manufactures test report from next page.





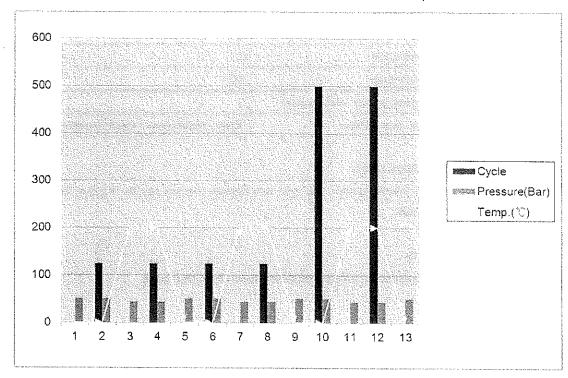
### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No.  | SWI-FET-10   |
|-------------|--------------|
| Issued Date | 16. MAR.2011 |
| CHECKED BY  | ManJong, Ko  |
| APPROVED BY | Yongpyo,Cho  |

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### 6. TEST STEPS

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



### STEP

### 7. TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

TEST FROM ROOM TEMPERATURE TO +200℃



Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |
|-------------|---------------|--------------|--|
|             |               | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 52          | Room. Temp.   | 0            | 1.0 x 10 <sup>-7</sup>                     |

### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage      |
|---------------|-------------|---------------|----------------------|
|               |             |               | (atm x cm³ x s⁻¹)    |
| 125           | 52          | Room. Temp.   | 1.5x10 <sup>-7</sup> |



### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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| CHECKED BY  | ManJong,Ko   |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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### 

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |  |
|-------------|---------------|--|--|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |
| 44          | 200           | 1.6 x10 <sup>-7</sup>                      |  |

### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200°C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage       |
|---------------|-------------|---------------|-----------------------|
|               |             |               | (atm x cm³ x s⁻¹)     |
| 125           | 44          | 200           | 2.5 x10 <sup>-7</sup> |

### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.("C) | Packing leakage                            |  |
|-------------|----------------|--|--|
|             |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |
| 52          | Room. Temp.    | 3.2 x10 <sup>-7</sup>                      |  |

### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 52          | Room, Temp.   | 2.9 x10 <sup>-7</sup>                      |

### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200°C

| Pres. (BAR) | Body Temp.(℃) | Packing leakage       |
|-------------|---------------|-----------------------|
|             |               | (atm x cm³ x s⁻¹)     |
| 44          | 200           | 3.4 x10 <sup>-7</sup> |

### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200℃

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage       |
|---------------|-------------|---------------|-----------------------|
|               |             |               | (atm x cm³ x s⁻¹)     |
| 125           | 44          | 200           | 3.6 x10 <sup>-7</sup> |

### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |                |
|-------------|---------------|--|----------------|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | EUREAU VERITAS |
| 52          | Room, Temp,   | 4.2 x10 <sup>-7</sup>                      | DREVIEWED      |
|             |               |  | BELFER         |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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|-------------|--------------|
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| CHECKED BY  | ManJong,Ko   |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage        |  |  |
|---------------|-------------|---------------|------------------------|--|--|
|               |             |               | ((atm x cm³ x s⁻¹)     |  |  |
| 500           | 52          | Room, Temp.   | 4.0 x 10 <sup>-7</sup> |  |  |

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200°C

| Pres. (BAR) | Body Temp.(°C) | Packing leakage(atm x cm³ x s-1) |
|-------------|----------------|----------------------------------|
| 44          | 200            | 3.6 x10 <sup>-7</sup>            |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200°C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 500           | 44          | 200           | 4.2 x10 <sup>-7</sup>                      |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |  |  |  |
|-------------|---------------|--------------|--|--|--|--|
|             |               | leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |  |
| 52          | Room Temp.    | 15           | 4.1 x10 <sup>-7</sup>                      |  |  |  |

#### POST TEST EXAMINATION

No visible damage and wear on stem packing area

GUREAU VERITAS
COREVIEWED
CHYVITNESSED
BOATE



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.NO.  | SWI-FET-10   |
|-------------|--------------|
| ISSUED DATE | 16. MAR.2011 |
| CHECKED BY  | ManJong,Ko   |
| Approved By | Yongpyo,Cho  |
|             |              |

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#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS A                                    |
|---------------------------|--|
| Body & bonnet gasket seal | ≤50 ppmv                                   |
| Stuffing box stem seal    | ≤10°(mgxs <sup>-1</sup> xm <sup>-1</sup> ) |
|                           | Equivalent to                              |
|                           | ≤5.6x10⁴(atm x cm³ x s⁻¹)                  |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal : stem diameter 25.0 mm

|                        | CLASS A  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter( 0.025m )x π x5.56x 10 <sup>-8</sup>     |
|                        | (atm x cm <sup>3</sup> x s <sup>-1</sup> )             |
|                        | = $4.4 \times 10^{-7} (atm \times cm^3 \times s^{-1})$ |

Conclusion: values observed quality valve to:

#### **TIGHTNESS CLASS: AH**

With no packing adjusted≤SSA0> for re tightening

#### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 200 °C

Performance class: ISO FE AH- CO2 - SSA0 - t- (200°C)-CL600- ISO 15848-1

EUREAU VERITAS

DEVIEWED

WITNESSED

DOTE

| TEST CHECKED BY:                  | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| Man Jong , Ko                     | Yong Pyo, Cho                       |
| A.                                | YAlb                                |
| DATE: MAR 16 <sup>TH</sup> , 2011 | DATE: : MAR 16 <sup>TH</sup> , 2011 |





#### SWI Vaive Co., Ltd.

Head office & Plant 1:1023-2 Covernancy-doing, Congaregu. Anyang-si Gyeonggi-do Korea Tel +82 31 421 1831 ~3 Fax +82 31 421 1834 Plant 21 801-3 Goryeom-ri, Cheongbus myeon, Pyeongbask si, Gyeonggi-da, Karea Tel 482 31 684 7981-3 Fax 487 31 684 1984 www.sivera.ce.com

### **TEST/INSPECTION CERTIFICATE**

DATE: 2011.02.07

SWI ORDER NO.: SO2010100089

CERTIFICATE NO.

: 100089-1

PROJECT NAME / NO: Fugitive Emission Test Sample

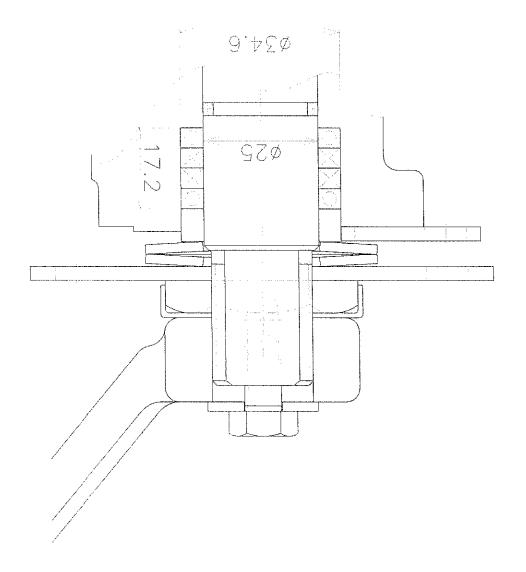
CUSTOMER/CLIENT: SWI Valve Co., Ltd.

PO NO.:

| TAG NO.                               | ITEM DESCRIPTION                              | Class<br>Press | SIZE   | Q'ty     | Hydros<br>(kç | static Test<br>y/cm²) | Air Test<br>(kg/cm²)   | Materials(ASTM)                                 |                                       |          | Dimen<br>-sion        | Visual<br>Inspe |          | Result |         |
|---------------------------------------|---|----------------|--------|----------|---------------|-----------------------|--|---|---------------------------------------|----------|-----------------------|-----------------|----------|--------|---------|
|                                       |   | -ure           | (inch) | Griy     | Shell         | Seat /<br>Backseat    | Seat   | Body &<br>Bonnet                                | Seat Ring<br>(Seat)                   | Stem     | Wedge/ Disc<br>(Ball) | Check           | -ction   | Test   | Nesult  |
|                                       | 2-P BALL V/V RF                               | 300#           | 2"     | 1        | 80            | N.A                   | 7  | A216-WCB  | RTFE                                  | A276-316 | A276-316              | GOOD            | GOOD     | GOOD   | ACCEPTI |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        | ****    |
|                                       |   |                |        |          |               |                       |  | Trust   | · · · · · · · · · · · · · · · · · · · |          |                       | :               |          |        |         |
| · · · · · · · · · · · · · · · · · · · |   |                |        |          |               |                       |  | [   |                                       |          |                       |                 |          |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          | :      |         |
|                                       |   |                |        |          |               |                       |  |   | <del> </del>                          |          |                       |                 | <u>.</u> |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        |         |
|                                       |   |                |        |          |               |                       |  |   |                                       |          |                       |                 |          |        |         |
| Remarks                               | These standard for ins     HF: STELLITE NO. 6 |                |        | to API s | 598           |                       | Verification of the property o | UMEAU VER<br>TREVIEWED<br>I WITNESSEI<br>D DATE | TAS                                   |          | ssed / Reviewe        |                 |          | Rep.   |         |

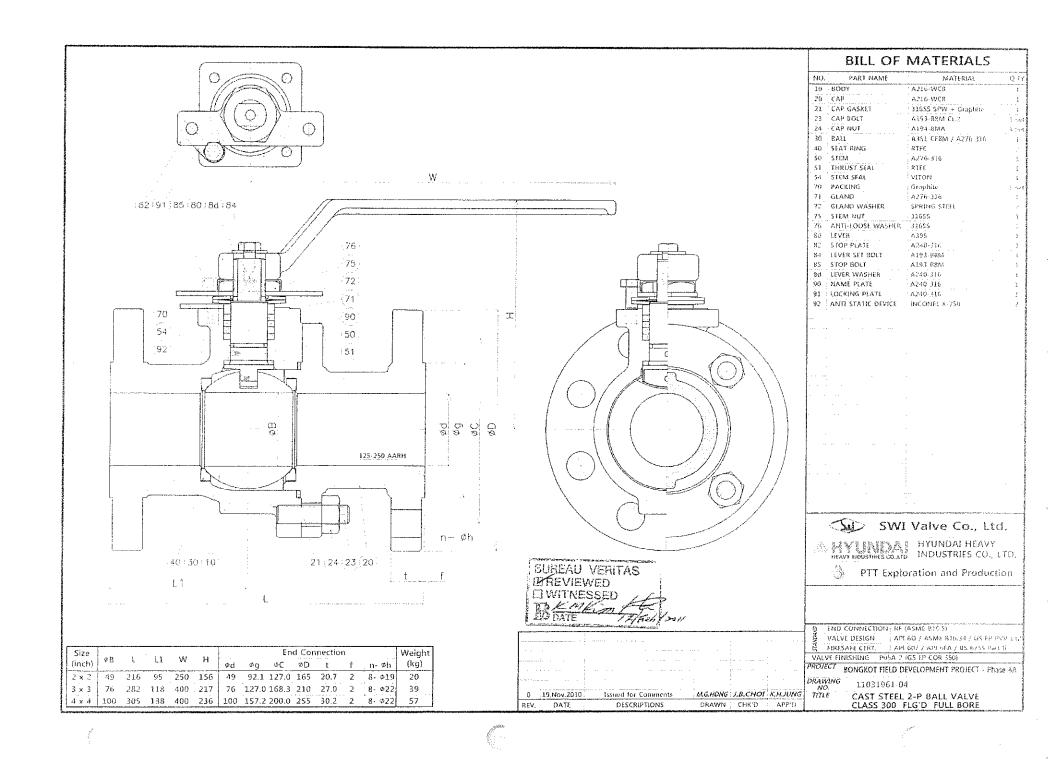
SWI-FORM QA-013

1 of 1



# BVIT





# 2014 ELP Compliance Status Report Consent Decree No. 1:11-cv-13330-TLL-CEB

# See Corresponding Tab in the Confidential Binder for Relevant Documentation

## Orbit Response

#### Smith, Vanessa (A)

om:

Smith, Vanessa (A)

nt:

Thursday, February 07, 2013 12:12 PM

To:

'tom.stricklen@c-a-m.com'

Cc:

DeVine, Dan (DJ); rchristian@columbiapipe.com; Burdick, Matthew (MJ); Dahl, Kathy (KA)

Subject:

Orbit: 2013 Low E Technology

Attachments:

FW: LDAR Low Fugitive Emission Questionnaire

#### Good Afternoon,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Attached are the completed questionnaires and any supporting data that you provided.

Per the Consent Decree, each year we must revalidate the Low Emission valves and/or packing determinations. Please review the attached information that you provided in 2012 upon which we based our original determination. Once reviewed, please reply to the questions below:

- 1. Are the valves or packing that met the Low-E definition per the Dow Chemical Consent Decree in 2012 last year still Low-E? See definition below.
- 2. Do you have any valves or packing that qualify as Low-E per the definitions below since the last time the questionnaire was answered? If yes, please include the testing data.

"Low-Emissions Valve" or "Low-E Valve" shall mean either (i) or (ii) as follows:

- (i) A valve (including its specific packing assembly) for which the manufacturer has issued a written warranty that it will not emit fugitives at greater than 100 ppm, and that, if it does so emit at any time in the first five years, the manufacturer will replace the valve; provided however, that no valve shall qualify as "Low-E" by reason of written warranty unless the valve (including its specific packing assembly) either:
  - (a) first was tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty; or
  - (b) is as an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

Or

- (ii) A valve (including its specific packing assembly) that:
  - (a) Has been tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and that, during the test, at no time leaked at greater than 500 ppm, and on average, leaked at less than 100 ppm; or
  - (b) Is an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

NOTE: "Extension" shall mean that: (i) the tested and untested valves were produced by the same manufacturer to the same or essentially equivalent quality requirements; (ii) the characteristics of the valve that affect sealing performance (e.g., type of valve, stem motion, tolerances, surface finishes, loading arrangement, and stem and body seal material, design, and construction) are the same or essentially equivalent as between the tested valve and the untested valve; and (iii) the temperature and pressure ratings of the tested valve are at least as high as the temperature and pressure ratings of the untested valve.

Thank you for your time and assistance with this matter. All responses must be received by February 28th in order for us to review and make our 2013 determinations.

Sincerely,

Vanessa Smith
Environmental Delivery Specialist
Dow Automotive/Dow Pharma
Office: (989) 638-7774

Office: (989) 638-7774 Cell: (989) 213-7258 Smith, Vanessa (A)

Parker No Response

🌄 pm:

Smith, Vanessa (A)

ånt:

Wednesday, February 13, 2013 11:34 AM

To:

'rkyes@parker.com'

Cc:

Dahl, Kathy (KA); Burdick, Matthew (MJ); DeVine, Dan (DJ); 'Russ Christian'

Subject: Attachments: Parker 2013 Low E Technology Determination DOW Michigan Low-E Valve Questionnaire.docx

Good Morning,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Unfortunately, we did not receive a completed questionnaire in 2012. We are now working on our 2013 Low Emission Technology determinations according to the Consent Decree and attached is the questionnaire that was previously sent.

Could you please review and complete the questionnaire? Also, please provide any applicable testing data.

Thank you for your time and assistance with this matter. All responses must be received by February 28th in order for us to review and make our 2013 determinations.

Sincerely,

Vanessa Smith
The Dow Chemical Company
Ivironmental Delivery Specialist

∠ffice: (989) 638-7774 Cell: (989) 213-7258

Swazelok Response

#### Smith, Vanessa (A)

rom:

Smith, Vanessa (A)

ant:

Thursday, February 07, 2013 12:12 PM

To:

'Volcansek, Steven J.'; Kreutzberg, Clark T.; Wilson, Chelsea; Wilson, Richard

Cc:

DeVine, Dan (DJ); rchristian@columbiapipe.com; Burdick, Matthew (MJ); Dahl, Kathy (KA)

Subject:

Swagelok: 2013 Low E Technology

Attachments:

Swagelok - Fugitive Emissions Letter; EPA; FW: dow questionaire; RE: Scope of product for

Dow FE testing

#### Good Afternoon,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Attached are the completed questionnaires and any supporting data that you provided.

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1. Are the valves or packing that met the Low-E definition per the Dow Chemical Consent Decree in 2012 last year still Low-E? See definition below.



2. Do you have any valves or packing that qualify as Low-E per the definitions below since the last time the questionnaire was answered? If yes, please include the testing data.

"Low-Emissions Valve" or "Low-E Valve" shall mean either (i) or (ii) as follows:

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  - (a) first was tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty; or
  - (b) is as an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

Or

- (ii) A valve (including its specific packing assembly) that:
  - (a) Has been tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and that, during the test, at no time leaked at greater than 500 ppm, and on average, leaked at less than 100 ppm; or
  - (b) Is an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

NOTE: "Extension" shall mean that: (i) the tested and untested valves were produced by the same manufacturer to the same or essentially equivalent quality requirements; (ii) the characteristics of the valve that affect sealing performance (e.g., type of valve, stem motion, tolerances, surface finishes, loading arrangement, and stem and body seal material, design, and construction) are the same or essentially equivalent as between the tested valve and the untested valve; and (iii) the temperature and pressure ratings of the tested valve are at least as high as the temperature and pressure ratings of the untested valve.

Thank you for your time and assistance with this matter. All responses must be received by February 28th in order for us to review and make our 2013 determinations.

Sincerely,

Vanessa Smith
Environmental Delivery Specialist
Dow Automotive/Dow Pharma
Office: (989) 638-7774

Cell: (989) 213-7258

2

#### Holmes, Michael (EHS)

‴~om:

Volcansek, Steven J. [Steven.Volcansek@SWAGELOK.com]

⊿nt:

Friday, February 15, 2013 8:35 AM

To:

Kreutzberg, Clark T.; Krance, Joseph M.; Wilson, Chelsea; Smith, Vanessa (A); Wilson,

Richard

Subject:

RE: Swagelok: 2013 Low E Technology

Vanessa:

Thank you for asking Swagelok to update our status on Low E valves.

Please find below answers to your questions and our additions to the previous list of Low E capable products.

Feel free to contact me for with any questions.

Best Regards Steve

Steven J. Volcansek

Manager - Corporate Compliance 31400 Aurora Rd. Solon, Ohio 44139

440-649-5626

From: Smith, Vanessa (A) [mailto:VNowak3@dow.com]

Sent: Thursday, February 07, 2013 12:13 PM

To: Volcansek, Steven J.; Kreutzberg, Clark T.; Wilson, Chelsea; Wilson, Richard

Cc: DeVine, Dan (DJ); <a href="mailto:rchristian@columbiapipe.com">rchristian@columbiapipe.com</a>; Burdick, Matthew (MJ); Dahl, Kathy (KA)

Subject: Swagelok: 2013 Low E Technology

Good Afternoon,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Attached are the completed questionnaires and any supporting data that you provided.

Per the Consent Decree, each year we must revalidate the Low Emission valves and/or packing determinations. Please review the attached information that you provided in 2012 upon which we based our original determination. Once reviewed, please reply to the questions below:

1. Are the valves or packing that met the Low-E definition per the Dow Chemical Consent Decree in 2012 last year still Low-E? See definition below. Yes.

2. Do you have any valves or packing that qualify as Low-E per the definitions below since the last time the questionnaire was answered? Yes. See below. If yes, please include the testing data. Swagelok will not provide test data at this time. Test summary results and methodology is available for review and discussion during an on-site visit at the Swagelok factory in Solon, Ohio.

Add R63T to 60 Series (Ball valves) 83 Series (Ball valve) AFS Series (Ball valve) D Series (Globe valve)

"Low-Emissions Valve" or "Low-E Valve" shall mean either (i) or (ii) as follows:

- (i) A valve (including its specific packing assembly) for which the manufacturer has issued a written warranty that it will not emit fugitives at greater than 100 ppm, and that, if it does so emit at any time in the first five years, the manufacturer will replace the valve; provided however, that no valve shall qualify as "Low-E" by reason of written warranty unless the valve (including its specific packing assembly) either:
  - (a) first was tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty; or
  - (b) is as an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

Or

- (ii) A valve (including its specific packing assembly) that:
  - (a) Has been tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and that, during the test, at no time leaked at greater than 500 ppm, and on average, leaked at less than 100 ppm; or
  - (b) Is an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

NOTE: "Extension" shall mean that: (i) the tested and untested valves were produced by the same manufacturer to the same or essentially equivalent quality requirements; (ii) the characteristics of the valve that affect sealing performance (e.g., type of valve, stem motion, tolerances, surface finishes, loading arrangement, and stem and body seal material, design, and construction) are the same or essentially equivalent as between the tested valve and the untested valve; and (iii) the temperature and pressure ratings of the tested valve are at least as high as the temperature and pressure ratings of the untested valve.

Thank you for your time and assistance with this matter. **All responses must be received by February 28th** in order for us to review and make our 2013 determinations. Sincerely,

Vanessa Smith
Environmental Delivery Specialist
Dow Automotive/Dow Pharma
Office: (989) 638-7774



Cell: (989) 213-7258

#### Smith, Vanessa (A)

mo:

Ron Walters [ronw@TEADIT.com]

.ant:

Monday, February 25, 2013 3:38 PM

To:

Smith, Vanessa (A)

Cc:

DeVine, Dan (DJ); 'Russ Christian'; Burdick, Matthew (MJ); Dahl, Kathy (KA); Joel Baulch;

Chris Day

Subject:

RE: Teadit: 2013 Low E Technology

Attachments:

API 607 Fire Test - Teadit - Style 2237 Packing- May 2012.pdf; API 622 Fugitive Emission Test Report - Teadit Style 2237 - May 2012 (1).pdf; EF2013\_001 2237 Valvula Q-Plus ISO

15848 Rev1 (1).pdf; EF055 Q-Plus Valve.pdf

Vanessa,

The answer to question 1 is yes.

The answer to question 2 is yes, we have developed a graphitic control valve packing, Teadit Style 2237, which I am attaching testing information for your evaluation. Please note the test uses 5 cut rings of spool stock packing without live-loading.

I am going to be at your plant Thursday, February 28th for installation training on our 2236. If you need to have any discussion on the 2237 let Dan know and we can schedule some time after the training session.

Teadit has also developed a PTFE braided packing that we are filing patent registration and will be able to discuss in the near future. It tested single digit PPM Method 21 up to 500 deg. F in our test lab in Rio. I am the leader of MSS task group that completed a Scope for gitive Emissions test for PTFE products. I submitted to the API SCOPV chair and he has submitted for development by API. We should put the API task group together at our Spring meeting in April. I will keep you updated as it develops.

Warmest Regards,

Ron Walters
North America Product Manager
Fugitive Emissions Products
Cell: 985-513-0986
www.teadit-na.com

From: Smith, Vanessa (A) [VNowak3@dow.com] Sent: Friday, February 15, 2013 10:55 AM

To: Ron Walters

Cc: DeVine, Dan (DJ); 'Russ Christian'; Burdick, Matthew (MJ); Dahl, Kathy (KA)

Subject: Teadit: 2013 Low E Technology

Good Afternoon,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Attached are the completed questionnaires and any porting data that you provided.

Per the Consent Decree, each year we must revalidate the Low Emission valves and/or packing determinations. Please review the attached information that you provided in 2012 upon which we based our original determination. Once reviewed, please reply to the questions below:

- 1. Are the valves or packing that met the Low-E definition per the Dow Chemical Consent Decree in 2012 last year still Low-E? See definition below.
- 2. Do you have any valves or packing that qualify as Low-E per the definitions below since the last time the questionnaire was answered? If yes, please include the testing data.

"Low-Emissions Valve" or "Low-E Valve" shall mean either (i) or (ii) as follows:

- (i) A valve (including its specific packing assembly) for which the manufacturer has issued a written warranty that it will not emit fugitives at greater than 100 ppm, and that, if it does so emit at any time in the first five years, the manufacturer will replace the valve; provided however, that no valve shall qualify as "Low-E" by reason of written warranty unless the valve (including its specific packing assembly) either:
- (a) first was tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty; or
- (b) is as an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

0r

- (ii) A valve (including its specific packing assembly) that:
- (a) Has been tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and that, during the test, at no time leaked at greater than 500 ppm, and on average, leaked at less than 100 ppm; or
- (b) Is an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

NOTE: "Extension" shall mean that: (i) the tested and untested valves were produced by the same manufacturer to the same or essentially equivalent quality requirements; (ii) the characteristics of the valve that affect sealing performance (e.g., type of valve, stem motion, tolerances, surface finishes, loading arrangement, and stem and body seal material, design, and construction) are the same or essentially equivalent as between the tested valve and the untested valve; and (iii) the temperature and pressure ratings of the tested valve are at least as high as the temperature and pressure ratings of the untested valve.

Thank you for your time and assistance with this matter. All responses must be received by February 28th in order for us to review and make our 2013 determinations. Sincerely,

Vanessa Smith Environmental Delivery Specialist
Dow Automotive/Dow Pharma
fice: (989) 638-7774
cell: (989) 213-7258

#### Smith, Vanessa (A)

SW I Response

rom:

Smith, Vanessa (A)

ent:

Wednesday, February 13, 2013 11:34 AM

10:

'rkim@swivalves.com'

Cc:

'Russ Christian'; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject:

SWI 2013 Low E Technology Determination

Attachments:

DOW Michigan Low-E Valve Questionnaire.docx

#### Good Morning,

As you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission valves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Unfortunately, we did not receive a completed questionnaire in 2012. We are now working on our 2013 Low Emission Technology determinations according to the Consent Decree and attached is the questionnaire that was previously sent.

Could you please review and complete the questionnaire? Also, please provide any applicable testing data.

Thank you for your time and assistance with this matter. All responses must be received by February 28th in order for us to review and make our 2013 determinations. Sincerely,

Vanessa Smith

The Dow Chemical Company nvironmental Delivery Specialist

ffice: (989) 638-7774 Cell: (989) 213-7258

#### Smith, Vanessa (A)

rom:

RONNIE KIM [rkim@swivalves.com]

ent:

Thursday, February 14, 2013 11:04 AM

10:

Smith, Vanessa (A)

Cc:

'Russ Christian'; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject:

RE: SWI 2013 Low E Technology Determination

Attachments:

WinZip Compressed Attachments.zip; Low-E Valve Questionnaire.docx

See attached.

Ronnie Kim SWI Valve Corporation Ph#713-266-7033 Fax#281-261-7507 Cell#713-702-2864

From: Smith, Vanessa (A) [mailto:VNowak3@dow.com]

Sent: Wednesday, February 13, 2013 10:34 AM

To: rkim@swivalves.com

Cc: Russ Christian; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject: SWI 2013 Low E Technology Determination

Good Morning,

s you may recall, in late 2011 Dow Chemical Michigan Operations entered a Consent Decree requiring Low Emission alves and/or packing to be installed in the Covered Process Units. In early 2012, a questionnaire was sent to you to determine if your products met the specifications of the Consent Decree. Unfortunately, we did not receive a completed questionnaire in 2012. We are now working on our 2013 Low Emission Technology determinations according to the Consent Decree and attached is the questionnaire that was previously sent.

Could you please review and complete the questionnaire? Also, please provide any applicable testing data.

Thank you for your time and assistance with this matter. **All responses must be received by February 28th** in order for us to review and make our 2013 determinations. Sincerely,

Vanessa Smith
The Dow Chemical Company
Environmental Delivery Specialist
Office: (989) 638-7774

Cell: (989) 213-7258

#### LOW FUGITIVE EMISSION VALVE AND PACKING QUESTIONNAIRE

Two production units at The Dow Chemical Company **Michigan Operations Site** recently came under a Consent Decree from the EPA. One part of this Consent Decree requires installation of Low Fugitive Emission valves and/or Low Fugitive Emission valve stem packing that meets the definition shown below. It also requires supporting documentation.

"Low-Emissions Valve" or "Low-E Valve" shall mean either (i) or (ii) as follows:

- (i) A valve (including its specific packing assembly) for which the manufacturer has issued a written warranty that it will not emit fugitives at greater than 100 ppm, and that, if it does so emit at any time in the first five years, the manufacturer will replace the valve; provided however, that no valve shall qualify as "Low-E" by reason of written warranty unless the valve (including its specific packing assembly) either:
  - (a) first was tested by the manufacturer or a qualified testing firm pursuant to generallyaccepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty; or
  - (b) is as an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

Or

- (ii) A valve (including its specific packing assembly) that:
  - a. Has been tested by the manufacturer or a qualified testing firm pursuant to generallyaccepted good engineering practices for testing fugitive emissions and that, during the test, at no time leaked at greater than 500 ppm, and on average, leaked at less than 100 ppm; or
  - b. Is an Extension of another valve that qualified as "Low-E" per the definition of "Extension" listed below.

NOTE: "Extension" shall mean that: (i) the tested and untested valves were produced by the same manufacturer to the same or essentially equivalent quality requirements; (ii) the characteristics of the valve that affect sealing performance (e.g., type of valve, stem motion, tolerances, surface finishes, loading arrangement, and stem and body seal material, design, and construction) are the same or essentially equivalent as between the tested valve and the untested valve; and (iii) the temperature and pressure ratings of the tested valve are at least as high as the temperature and pressure ratings of the untested valve.

Therefore can you please answer ALL of the following questions regarding valves that could be supplied to The Dow Chemical Company, Michigan Operations Site? COMPANY NAME: \_\_SWI VALVE CORPORATION\_ 1) Will your company provide a written warranty for low emission valves as defined above? YES or NO? Yes, per ii a & b. If YES, please describe the testing (the nature of the test and the resulting data) that supports the warranty.(see attached) OR 2) Does your company produce valves that have been proven through testing to meet the emission limits in the definition for low emission valves? YES If yes to the above questions, what size and type of valves that your company produces will meet this definition or warranty? Please be specific as possible (i.e. which series of valves or models numbers). Ball? CN, CS, CT series Plug? Gate? AAF, AAB, AAD, AAE, AAH series Globe? ABF, ABB, ABD, ABE, ABH series **Butterfly?** Other? All bellowseal type gate, globe valves 3) Which valves, including sizes, were tested? (see attached) 4) Which valves, including sizes, are qualified per an extension? 5) Will you provide the test data to The Dow Chemical Company for review? If yes, please include it in the response.(see attached)

6) Does your Company offer a valve with low emission packing per the following definition?

"Low-Emissions Packing" or "Low-E Packing" shall mean either (i) or (ii) as follows:

(i) A valve packing product, independent of any specific valve, for which the manufacturer has issued a written warranty that the packing will not emit fugitives at greater than 100 ppm, and that, if it does so emit at any time in the first five years, the manufacturer will replace the product; provided however, that no packing product shall qualify as "Low-E" by reason of written warranty unless the packing first was tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions and the results of the testing reasonably support the warranty;

Or

- (ii) A valve packing product, independent of any specific valve that has been tested by the manufacturer or a qualified testing firm pursuant to generally-accepted good engineering practices for testing fugitive emissions, and that, during the test, at no time leaked at greater than 500 ppm, and on average leaked at less than 100 ppm.
- 7) If yes, for which valves would "Low-E Packing" be offered? All valves
- 8) For which types of packing is "Low-E" status based on a written warranty?
- 9) For which types of packing is "Low-E" status based on testing that shows the packing meets the emission limits in the definition above? (see attached packing spec)
- 10) If yes, can this Low-E Packing testing information be provided to The Dow Chemical Company for review? If yes, please include it with the response. (see attached)

Thank you for your assistance to help meet low emission compliance.

Please contact Dan DeVine at 989-636-4330, or by email at <a href="mailto:devinedi@dow.com">devinedi@dow.com</a> with questions or clarifications.

#### Smith, Vanessa (A)

rom:

Smith, Vanessa (A)

ent:

Monday, February 25, 2013 10:56 AM

íO:

'RONNIE KIM'

Cc:

'Russ Christian'; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject:

RE: SWI 2013 Low E Technology Determination

#### Ronnie,

Thank you for your response to our questions concerning Low Emission valves. In the zipped file, we noticed that there were only summary sheets of each test performed. Would you be able to provide us with the full test reports so we can fully evaluate our determinations? If this is confidential data, please indicate as appropriate and we will respect the sensitivity.

Regards, Vanessa

From: RONNIE KIM [mailto:rkim@swivalves.com]
Sent: Thursday, February 14, 2013 11:04 AM

To: Smith, Vanessa (A)

Cc: 'Russ Christian'; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject: RE: SWI 2013 Low E Technology Determination

See attached.

onnie Kim SWI Valve Corporation Ph#713-266-7033 Fax#281-261-7507 Cell#713-702-2864

From: Smith, Vanessa (A) [mailto:VNowak3@dow.com]

Sent: Wednesday, February 13, 2013 10:34 AM

To: rkim@swivalves.com

Cc: Russ Christian; Dahl, Kathy (KA); DeVine, Dan (DJ); Burdick, Matthew (MJ)

Subject: SWI 2013 Low E Technology Determination

#### Good Morning,

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Could you please review and complete the questionnaire? Also, please provide any applicable testing data.

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Sincerely,

Vanessa Smith

The Dow Chemical Company Environmental Delivery Specialist Office: (989) 638-7774

Cell: (989) 213-7258



Energy & Process

### TYPE APPOROVAL CERTIFICATE FOR GATE VALVE No. 940013/3-CT-01

| B.V. Job Ref: 3.30.1030.03   |
|--|
| nspection ordered to B.V. by (1) : SWI Valve Co. Ltd.<br>#1023-2 Gwanyang 1-dong,Dongan-gu, Anyang-si, Gyeonggi-do, K  |
| Manufacturer : SWI Valve Co. Ltd., Korea   |
| (1) the addressee of the original of this certificate;   |
| Description of the Supply / Subject of inspection :  |
| Product: Forged Steel Gate Valve Size of Tested Valve: 1° Material of Tested Valve: ASTM A105N Class of Tested Valve: #800 Stem Diameter: 11.1 mm Tightness class: BH Endurance class: CO2(1500cycles) Temperature class: t400℃  |
| Valves Qualified according to sizes: up to 2" (Stem Dia.: 5.5 to 22.2 mm)  Valves Qualified according to pressure ratings: #150 , #300 , #600, #800  Valves Qualified according to tightness class: BH  Valves Qualified according to Endurance class: CO2(1500cycles)  Valves Qualified according to temperature class: Room temperature to +400℃ |
| This certificate covers the whole of the supply:   YES (no more inspection planned)  NO (part of the supply still to be inspected)   |
| Scope of the B.V. Survey :   |
| - Witness for Type Test of Fugitive Emission Test  |
| This supply complies with the following applicable document (s): (2)   |
| - ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.  |
| List of enclosures: Test Report for Fugitive Emission Test ——— 9 Pages   |
| (or reference to enclosed list) The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.   |
| Marking and Stamping on the items: None  |
| Particulars or comments: This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactor. The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006.   |

Date of Issuance: 07-July-2010

Date of Inspection: 14 to 16-Jun-2010

Issued by:

Name : K. M. Kim

Sign:

Location of Inspection : BV-Korea, Seoul Office

This certificate is deliverared within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Veritas.

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.

Validated by : Name : Y. M. Moφη

SEOUL

ORS



 REPORT.No.
 SWI-FET-01

 ISSUED DATE
 05.JULY.2010

 CHECKED BY
 JONGWOO, SOHN

 APPROVED BY
 YONGPYO, CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

Page 1 of 6

## PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

Manufacturer : SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 14th June,2010 to 16th June,2010

#### 1 VALVE SPECIFICATION

| Valve size & type  | GATE Valve A105N/13CRFS SW 800#                  |  |  |  |  |
|--------------------|--|--|--|--|--|
|                    | BB RB 1"   |  |  |  |  |
| Material of Valve  | A105N  |  |  |  |  |
| Valve class        | 800#   |  |  |  |  |
| Stem diameter      | 11.1 mm  |  |  |  |  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |  |  |  |  |
|                    | Model No. : DAEWHA 6511+ 9001                    |  |  |  |  |
| Packing material   | Graphite , Graphite + Inconel Wire               |  |  |  |  |
| Operating torque   | 41 N/m   |  |  |  |  |
| Stroke             | 24.3 mm  |  |  |  |  |

#### 2TEST CONDITION

| Test pressure                 | 136-93bar  |            |
|-------------------------------|--|------------|
| Test medium                   | He 99%   |            |
| Check medium                  | He 99%   |            |
| Test temperature              | RT/ 400℃   |            |
| Test equipment                | Fugitive emission test equip, manufactured by SWI VALVE CO. LTD. |            |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)                     |            |
| Sampling method               | Random   |            |
| Valve repacking before test   | 0  |            |
| Insulation of test valve      | Heating Jacket used  | BUREAU VER |
| Actuator                      | Geared motor   | WITNESSE   |



| SWI-FET-01   |                              |
|--------------|------------------------------|
| 05.JULY.2010 |                              |
| JongWoo,Sohn |                              |
| YONGPYO, CHO |                              |
|              | 05.July.2010<br>JongWoo,Sohn |

#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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#### 3CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" + stem movement 8"+ close 2") |

#### 4DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### 5TEST RESULTS

Test results are recorded in manufactures test report from next page.

BUREAU VERITAS



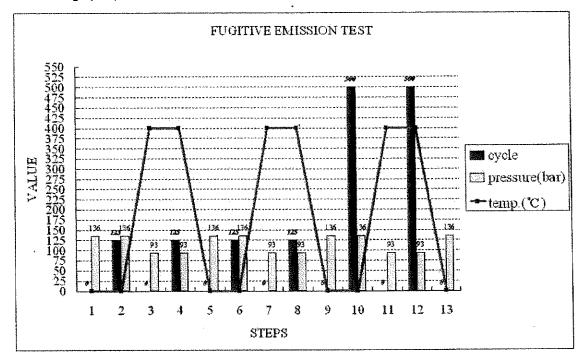
#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.  | SWI-FET-01   |
|-------------|--------------|
| ISSUED DATE | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### **6TEST STEPS**

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### 7 TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

TEST FROM ROOM TEMPERATURE(-29℃ ~+40℃) to +400℃.

### Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(°C) | Body-Bonnet  | Packing leakage                            | Packing |
|------------|----------------|--------------|--|---------|
|            |                | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | torque  |
|            |                |              |  | Nm      |
| 136        | Room, Temp.    | 0 .          | 1.63 x10 <sup>-8</sup>                     | 40      |

#### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 136        | Room, Temp.   | 9.563 x10 <sup>-8</sup>                    |

#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|------------|---------------|--|
|            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93         | 400           | 2.63x10 <sup>-8</sup>                      |

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| APPROVED BY | Yongpyo,Cho   |

#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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BUREAU VERITAS

**WITNESSED** 

#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            | •             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 93         | 400           | 2.36 x10 <sup>-7</sup>                     |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|------------|---------------|--|
|            | •             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 136        | Room. Temp.   | 4.86x10 <sup>-7</sup>                      |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |
|---------------|------------|----------------|--|
|               |            | ,              | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 136        | Room, Temp.    | 8.363 x10 <sup>-7</sup>                    |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(°C) | Packing leakage         |
|------------|----------------|-------------------------|
|            |                | (atm x cm³ x s-1)       |
| 93         | 400            | 8.363 x10 <sup>-7</sup> |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 93         | 400           | 2.78 x10 <sup>-4</sup>                     |

#### - In this point, One Packing adjustment is taken for re-tightening.

#### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Packing leakage         | Packing torque |  |  |  |
|------------|---------------|-------------------------|----------------|--|--|--|
|            |               |                         | Nm             |  |  |  |
| 136        | Room temp.    | 1.267 x10 <sup>-7</sup> | 39             |  |  |  |

#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |  |  |
|---------------|------------|---------------|--|--|--|--|
| 1             |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |  |
| 500           | 136        | Room. Temp.   | 9.36 x10 <sup>-6</sup>                     |  |  |  |



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| ISSUED DATE | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| APPROVED BY | Yongpyo,Cho  |

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|------------|---------------|--|
|            | •             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93         | 400           | 7.369 x10 <sup>-6</sup>                    |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |  |  |
|---------------|------------|---------------|--|--|--|--|
| :             |            | ,             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |  |
| 500           | 93         | 400           | 7.369x10 <sup>-6</sup>                     |  |  |  |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres.(BAR) | Body Temp.(°C) | Body-Bonnet  | Packing leakage                            |
|------------|----------------|--------------|--|
|            |                | leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 136        | Room Temp.     | 36           | 4.263 x10 <sup>-6</sup>                    |

POST TEST EXAMINATION

No visible damage or wear on stem packing area

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WITNESSED

DATE

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REPORT.NO. SWI-FET-01
ISSUED DATE 05.JULY.2010
CHECKED BY JONGWOO,SOHN
APPROVED BY YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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|                           | CLASS B  |
|---------------------------|--|
| Body & bonnet gasket seal | ≤ <u>5</u> 50 ppmv   |
| Stuffing box stem seal    | ≤10 <sup>-4</sup> (mgxs <sup>-1</sup> xm <sup>-1</sup> )   |
|                           | Equivalent to  |
|                           | $\leq 1.76 \times 10^{-6} (atm \times cm^3 \times s^{-1})$ |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal : stem diameter 11.1 mm

|                        | CLASS B  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter 11.1 x 1.76x10 <sup>-6</sup>                           |
|                        | (atm x cm <sup>3</sup> x s <sup>-1</sup> )                           |
|                        | = 1.9536x10 <sup>-5</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: BH** 

With one packing adjusted < SSA1> for re tightening

#### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 400 ℃

Performance class : ISO FE BH- CO2 - SSA1 - t- (400 °C)-CL800- ISO 15848-1

SUREAU VERITAS
MREVIEWED
MWITNESSED
DATE
DATE

| TEST CHECKED BY:                  | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| JONG WOO , SOHN                   | YONG PYO, CHO                       |
| m                                 | y P Cho                             |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |





## TEST/INSPECTION CERTIFICATE

DATE: 2010, 06, 11

SWI ORDER NO.: SO20100300254

1023-2, Kwanyang-Dong, Dongan-Gu, Anyang, Kyunggi-Do, Korea, TEL: 82-31-422-7495/7 FAX: 82-31-422-7498

CERTIFICATE NO.

: 1003254

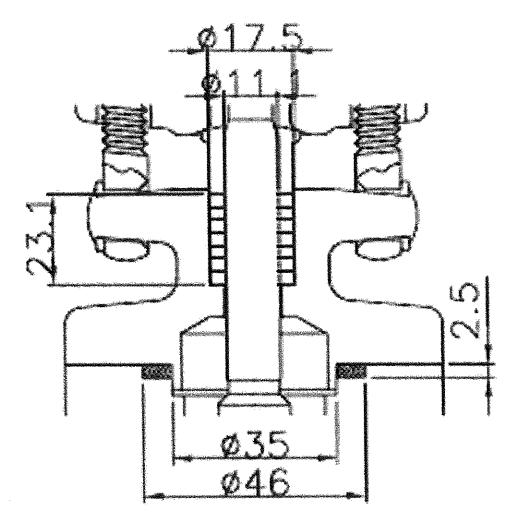
PROJECT NAME / NO: Fugitive Emission Test sample

CUSTOMER/CLIENT : SWI Valve co. Ltd.

PONO.:

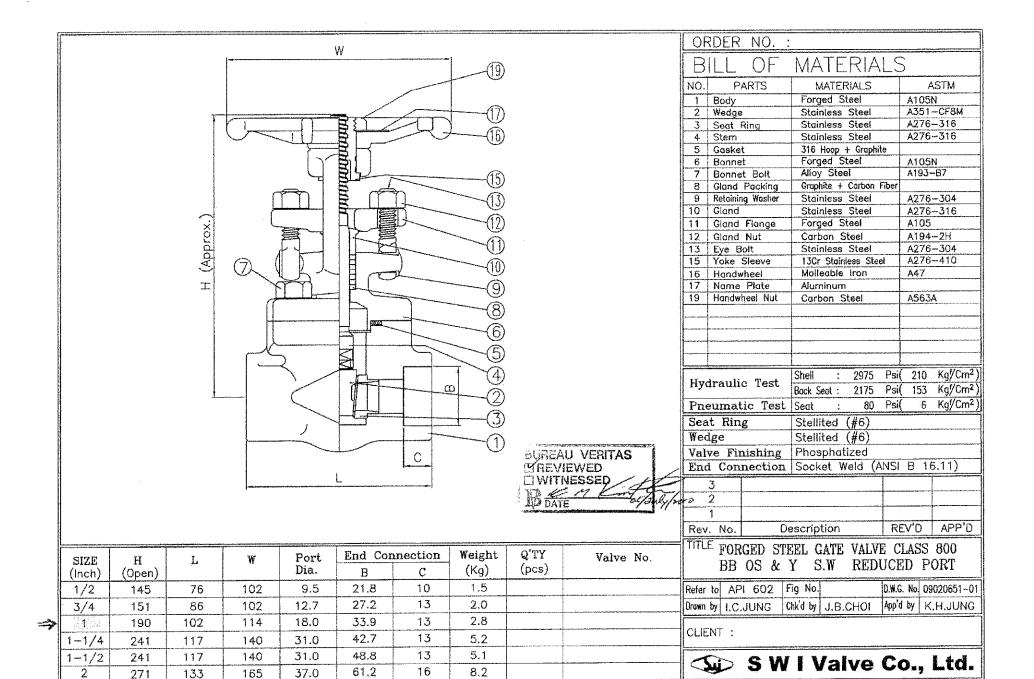
|                          | ITEM DESCRIPTION  | Class                 | SIZE     | Q¹ty  | Hydro<br>(k | static Test<br>g/cm²) | Air Test<br>(kg/cm²) |                  | Materials  | s(ASTM)  |  | Dimen<br>-sion   | Visual<br>Inspe | Functi<br>-onal        | Result   |
|--------------------------|---|-----------------------|----------|-------|-------------|-----------------------|----------------------|------------------|--|----------|--|--|-----------------|------------------------|--|
| NO.                      |   | Press<br>-ure         | (inch)   | Garty | Shell       | Seat /<br>Backseat    | Seat                 | Body &<br>Bonnet | Seat Ring<br>(Seat)  | Stem     | Wedge/ Disc<br>(Ball)  | Check  | -ction          | Test                   |  |
| ························ | GATE V/V SW   | 800#                  | 1"       | 1     | 210         | N.A/153               | 6                    | A105N            | A276-410/HF  | A276-410 | A217-CA15/HF   | GOOD   | GOOD            | GOOD                   | ACCEPTE  |
|                          |   |                       |          |       |             |                       |                      | No.              | and the same of th |          | Andrew Control of the |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  | and a share of the |          |  |  |                 |                        |  |
|                          |   |                       | <u> </u> |       |             |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  |  |          |  |  |                 | <u> </u>               |  |
|                          |   |                       |          |       | ļ           |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       | <b> </b>    |                       |                      |                  |  |          |  | The state of the s | HOTE E A A A    | Property of the second | and the same of th |
|                          |   |                       |          |       | <u> </u>    |                       |                      | ,                |  |          |  | MA   | EVIEW           | EMITAS<br>D<br>ED      |  |
|                          |   |                       | <u> </u> |       | -           |                       |                      |                  |  |          |  | LIV  | INES            |                        | 150/1  |
| <b></b>                  |   |                       | ļ        |       |             |                       |                      |                  |  |          |  | 1.44   | PATE            | 01                     | 1331/10  |
|                          |   |                       |          | 500   | <u> </u>    |                       |                      | <u> </u>         |  | Witn     | essed / Review   | ed by C  | ustome          | r Rep.                 |  |
| emar<br>ks               | These standard for inspecting the standard for inspec | on contorn<br>Facing. | 1 to API | ರಚಿತ  |             |                       |                      |                  |  |          |  |  |                 |                        |  |
|                          |   |                       |          |       |             |                       |                      |                  |  |          |  | - iii  |                 |                        | <u> </u>   |
| -/                       | HEREBY CERTIFY THAT TH  |                       |          |       |             |                       |                      |                  |  |          | <u> Manager</u>  | V  |                 |                        |  |

**SWI-FORM QA-013** 





Gale





**Energy & Process** 

## TYPE APPOROVAL CERTIFICATE FOR GLOBE VALVE No. 940013/3-CT-02

| 110. 5400 10,5   | V1-V&  |
|--|--|
| B.V. Job Ref: 3.30.1030.03   |  |
| Inspection ordered to B.V. by (1): SWI Valve Co. Ltd. #1023-2 Gwanyang 1-don   | g,Dongan-gu, Anyang-si, Gyeonggi-do, Kore  |
| Manufacturer : SWI Valve Co. Ltd., Korea   |  |
| (1) the addressee of the original of this certificate;   |  |
| Description of the Supply / Subject of inspection:   |  |
| Product: Forged Steel Globe Valve Size of Tested Valve: 1" Material of Tested Valve: ASTM A105N Class of Tested Valve: #800 Stem Diameter: 12.7 mm Tightness class: BH Endurance class: CO2(1500cycles) Temperature class: t400°C  |  |
| Valves Qualified according to sizes: up to 2" (Stem Dia.: 6.35 Valves Qualified according to pressure ratings: #150, #300, # Valves Qualified according to tightness class: BH Valves Qualified according to Endurance class: CO2(1500cyc Valves Qualified according to temperature class: Room temperature class: Room temperature class:   | #600, #800 <sup>*</sup>  |
| This certificate covers the whole of the supply:   YES (no more inspection plants)   | anned) NO (part of the supply still to be inspected)                                       |
| Scope of the B.V. Survey :   | <b>A</b>   |
| - Witness for Type Test of Fugitive Emission Test  |  |
| This supply complies with the following applicable do - ISO 15848-1 Industrial Valves-Measurement, Test and Quali (2) and only for parts of the document(s) which concern the certification or the relevant of the document of the certification or the relevant of the certification of the certification or the relevant of the certification of the relevant of the certification or the relevant of the certification of the certification of the relevant of the certification of the relevant of the certification of | fication Procedure for Fugitive Emission vant service provided by Bureau Veritas.  9 Pages |
| The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pa  | ages) which are stamped, are considered as part of this certificate.                       |
| Marking and Stamping on the items: None  Particulars or comments: This is to certify that the following valves have been inspected to the Fugitive Emission Test in accordance with ISO 15848-1 Ed   |  |
| Date of Issuance : 07-July-2010 Issued by : Date of Inspection : 17 to 19-Jun-2010 Name : K. M. Kim Sign :   | Validated by :<br>Name : Y. M. Moon<br>Sign :  |
| Location of Inspection: BV-Korea, Seoul Office  This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est déliveré dans le cadre des Conditions Générales de Service du Bureau Veritas  | SEPTER BOOK  |
| This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal.  This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.   | SEOUL)   |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.  | SWI-FET-02   |  |
|-------------|--------------|--|
| Issued Date | 05.July.2010 |  |
| CHECKED BY  | JONGWOO,SOHN |  |
| APPROVED BY | Yongpyo,Cho  |  |
|             |              |  |

Page 1 of 6

## PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 17<sup>th</sup> June,2010 to 19<sup>th</sup> June,2010

#### 1 VALVE SPECIFICATION

| Valve size & type  | GLOBE Valve A105N/13CRFS SW 800# |  |  |
|--------------------|----------------------------------|--|--|
|                    | BB RB 1"                         |  |  |
| Material of Valve  | A105N                            |  |  |
| Valve class        | 800#                             |  |  |
| Stem diameter      | 12.7 mm                          |  |  |
| Gland packing type | GRAPHITE BRAIDED PACKING +       |  |  |
|                    | GRAPHITE MOLDED PACKING          |  |  |
| Packing material   | GRAPHITE, GRAPHITE+INCONEL WIRE  |  |  |
| Operating torque   | 42 N/m                           |  |  |
| Stroke / Angle     | 7.8mm                            |  |  |

#### 2TEST CONDITION

| Test pressure                 | 136-93bar  |                |
|-------------------------------|--|----------------|
| Test medium                   | He 99%   |                |
| Check medium                  | He 99%   |                |
| Test temperaturé              | RT/ 400°C  |                |
| Test equipment                | Fugitive emission test equip, manufactured by SWI VALVE CO. LTD. |                |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)                     |                |
| Sampling method               | Random   |                |
| Valve repacking before test   | 0  | BUREAU VERITAS |
| Insulation of test valve      | Heating Jacket used  | ## WITNESSED   |
| Actuator                      | Geared motor   | B DATE         |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| œ. |             |                       |  |  |  |
|----|-------------|-----------------------|--|--|--|
| -  | REPORT NO.  | SWI-FET-02            |  |  |  |
|    | ISSUED DATE | 05.July. <b>2</b> 010 |  |  |  |
|    | CHECKED BY  | Јонс-Ори              |  |  |  |
| -  | APPROVED BY | Yongpyo,Cho           |  |  |  |
| ł  |             |                       |  |  |  |

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#### 3CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" + stem movement 8"+ close 2") |

#### 4DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### **5TEST RESULTS**

Test results are recorded in manufactures test report from next page.

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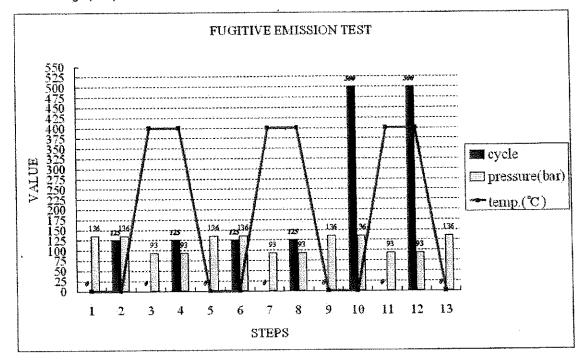
#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| SWI-FET-02   |
|--------------|
| 05.July.2010 |
| JONGWOO,SOHN |
| Yongpyo,Cho  |
|              |

Page 3 of 6

#### **6TEST STEPS**

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### 7 TEST TABLE

The following table describes total of 13 steps and leakage rates in order MREVIEWED

BUREAU VERITAS
MREVIEWED
MUITNESSED
DATE

TEST FROM ROOM TEMPERATURE( $-29\,^{\circ}\text{C} \sim +40\,^{\circ}\text{C}$ ) to  $+400\,^{\circ}\text{C}$ .

Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR)(BAR) | Body          | Body-Bonnet  | Packing leakage                            | Packing |
|-----------------|---------------|--------------|--|---------|
|                 | Temp.(°C)(°C) | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-i</sup> ) | torque  |
|                 | •             |              | ,  | Nm      |
| 136             | Room. Temp.   | 0            | 8.366 x10 <sup>-7</sup>                    | 39      |

Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 136        | Room. Temp.   | 3.34 x10 <sup>-6</sup>                     |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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|-------------|---------------|
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| Снескед Ву  | JongWoo,Sohn  |
| APPROVED BY | Yongpyo,Cho   |
|             |               |

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#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|------------|---------------|--|
|            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93         |               | $2.845 \times 10^{-6}$                     |

#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 93         | 400           | 4.36 x10 <sup>-6</sup>                     |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|------------|---------------|--|
|            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 136        | Room, Temp,   | 7.261 x10 <sup>-5</sup>                    |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-4</sup> ) |
| 125           | 136        | Room, Temp.   | 1.236 x10 <sup>-5</sup>                    |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

| Pres.(BAR) | Body Temp.(°C) | Packing leakage                            |
|------------|----------------|--|
|            |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93         | 400            | 2.312 x10 <sup>-6</sup>                    |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400°C

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage   |
|---------------|------------|---------------|---|
| 125           | 93         | 400           | (atm x cm <sup>3</sup> x s <sup>-1</sup> )<br>9.369 x10 <sup>-5</sup> |

Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

|            | · · · · · · · · · · · · · · · · · · · |                                   | MINITALESSED |
|------------|---------------------------------------|-----------------------------------|--------------|
| Pres.(BAR) | Body Temp.(℃)                         | Packing leakage<br>(atm x cm³ x s | MA 754 15    |
| 136        | Room. Témp.                           | 5.362 x10 <sup>-5</sup>           |              |

FORM-FET-01

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#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

| REPORT.No.  | SWI-FET-02   |
|-------------|--------------|
| Issued Date | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |  |
|---------------|------------|---------------|--|--|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |
| 500           | 136        | Room. Temp.   | 3.611 x10 <sup>-2</sup>                    |  |  |

- In this point, One Packing adjustment is taken for re-tightening.

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

|   | Pres.(BAR) | Body Temp.(℃) | Packing leakage        | Packing torque |
|---|------------|---------------|------------------------|----------------|
| *************************************** |            |               |                        | Nm             |
|   | 93         | 400           | 8.13 x10 <sup>-5</sup> | 39             |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400℃

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |  |
|---------------|------------|---------------|--|--|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |
| 500           | 93         | 400           | 4.45 x10 <sup>-5</sup>                     |  |  |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres.(BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |  |  |
|------------|---------------|--------------|--|--|--|
|            |               | leakage(ppm) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |
| 136        | Room Temp.    | 37           | 3.178 x10 <sup>-4</sup>                    |  |  |

POST TEST EXAMINATION

FORM-FET-01

No visible damage or wear on stem packing area

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#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO15848-1 >

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| APPROVED BY | Yongpyo,Cho  |  |  |  |  |
|             |              |  |  |  |  |

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#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS B  |
|---------------------------|--|
| Body & bonnet gasket seal | ≤50 ppmv   |
| Stuffing box stem seal    | ≤10 <sup>-4</sup> (mgxs <sup>-1</sup> xm <sup>-1</sup> )   |
|                           | Equivalent to  |
|                           | $\leq 1.76 \times 10^{-6} (atm \times cm^3 \times s^{-1})$ |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal: stem diameter 12.7 mm

|                        | CLASS B  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter (12.7mm) x 1.76x10 <sup>-6</sup>           |
|                        | (atm x cm <sup>3</sup> x s <sup>-1</sup> )               |
| •                      | $= 2.235 \times 10^{-5} (atm \times cm^3 \times s^{-1})$ |

Conclusion: values observed quality valve to:

TIGHTNESS CLASS: BH

With one packing adjusted≤SSA1> for re tightening

**ENDURANCE CLASS:** 

CO2 1,500 cycles

TEMPERAUTRE CLASS:

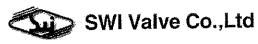
Room temperature to 400℃

Performance class: ISO FE BH- CO2 - SSA1 - t- (400 °C)-CL800- ISO 15848-1

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WITNESSED
DATE
OSSUMBLE

| TEST CHECKED BY                  | : TEST APPROVED BY :                  |
|----------------------------------|---------------------------------------|
| JONG WOO, SOHN                   | YONG PYO, CHO                         |
| /a                               | Ypcho                                 |
| DATE: July 5 <sup>TH</sup> , 201 | 0 DATE: : July 5 <sup>TH</sup> , 2010 |





## TEST/INSPECTION CERTIFICATE

DATE: 2010. 06. 16

SWI ORDER NO.: SO20100300254

1023-2, Kwanyang-Dong, Dongan-Gu, Anyang, Kyunggi-Do, Korea. TEL: 82-31-422-7495/7 FAX: 82-31-422-7498

CERTIFICATE NO.

: 1003254

PROJECT NAME / NO: Fugitive Emission Test sample

CUSTOMER/CLIENT :

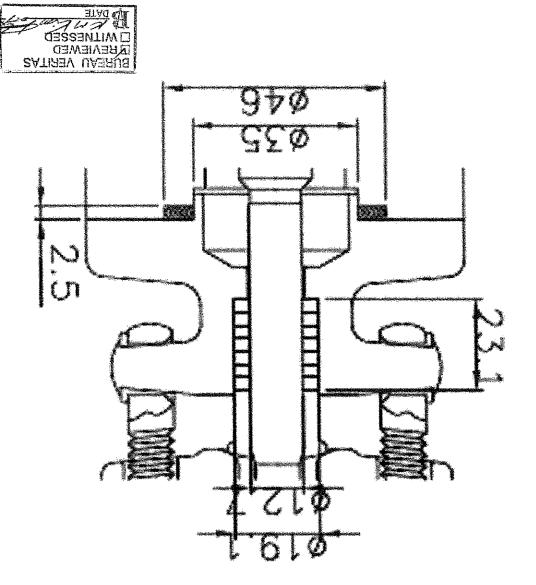
SWI Valve co. Ltd.

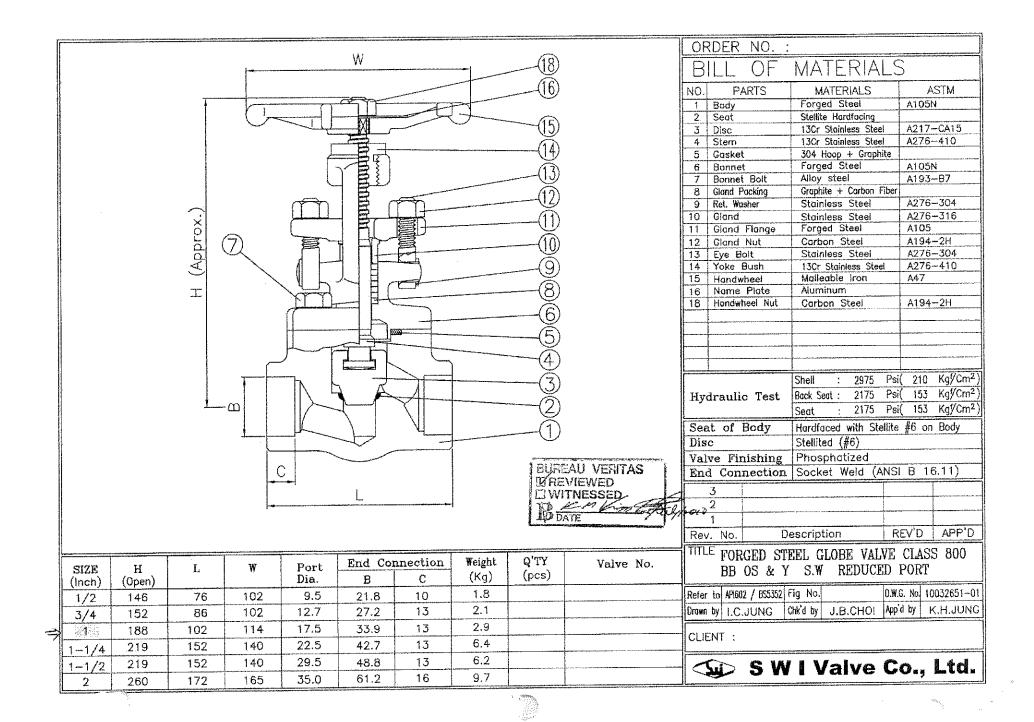
P O NO.:

|   | ITEM DESCRIPTION   | Class<br>Press           | SIZE     | SIZE     | SIZE     | SIZE               | SIZE    | SIZE   | SIZE   | SIZE     | SIZE   | SIZE     | SIZE              | Q'ty   | Hydro<br>(k | static Test<br>g/cm²) | Air Test<br>(kg/cm²) |  | Materials(ASTM) |  |  | Dimen<br>-sion | Inspe | Functi<br>-onai | Result |
|---|--|--------------------------|----------|----------|----------|--------------------|---------|--|--|----------|--|----------|-------------------|--|-------------|-----------------------|----------------------|--|-----------------|--|--|----------------|-------|-----------------|--------|
| NO.                                     |  | -ure                     | (inch)   | u, ty    | Shell    | Seat /<br>Backseat | Seat    | Body &<br>Bonnet   | Seat Ring<br>(Seat)  | Stem     | Wedge/ Disc<br>(Ball)  | Check    | -ction            | Test   |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   | GLOBE V/V SW   | 800#                     | 1"       | 1        | 210      | 153/153            | N/A     | A105N  | A276-410/HF  | A276-410 | A217-CA15/HF   | GOOD     | GOOD              | GOOD   | ACCEPTE     |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          | Market and the second s |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
| *************************************** |  |                          |          |          |          |                    |         |  |  |          |  |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   | 1,000  |                          |          |          |          |                    |         |  |  |          | and the state of t |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   | AND THE RESIDENCE OF THE PROPERTY OF THE PROPE |                          |          |          |          |                    |         |  |  |          |  |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   | ***************************************  |                          |          |          |          |                    |         | And an analysis of the second  |  |          | and the state of t |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   | 4  |                          | 1        |          |          |                    |         |  |  |          |  |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          |  |          | W. 100 11 / Marie |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          |  |          | SUFFE             | U VEI<br>VIEWEL  | ITAS        |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          |  |          | FUVI              | TNESSE   | 22          |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          |  |          | BL                | (E   | स्मिथा      |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          | <b>-</b> |          |                    |         |  |  |          |  |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         |  |  |          |  |          |                   |  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          | 1        |          |                    |         |  |  |          |  |          |                   | <u> </u>   |             |                       |                      |  |                 |  |  |                |       |                 |        |
| emai<br>ks                              | r 1. These standard for inspect<br>2. HF : STELLITE NO. 6 Hard   | ion conform<br>I Facing. | n to API | 598      | <u></u>  |                    |         | All the second s |  | Witn     | essed / Review   | ed by C  | ustome            | er Rep.  |             |                       |                      |  |                 |  |  |                |       |                 |        |
|   |  |                          |          |          |          |                    |         | and or holy design and the second an | and the second s | Q.A      | <u>Manager</u>   |          |                   | A STATE OF THE STA | 1           |                       |                      |  |                 |  |  |                |       |                 |        |
|   | HEREBY CERTIFY THAT TI   | ic occili                | TOME     | NITIO    | VIELY VI | ROVE ARE           | TRHE AN | ID CORREC  | T IN EVERY DE  | TAIL     | <u> </u>   | <b>7</b> |                   | Commercial Contract C | W. Car      |                       |                      |  |                 |  |  |                |       |                 |        |

**SWI-FORM QA-013** 

## eqole







Energy & Process

#### TYPE APPOROVAL CERTIFICATE FOR GATE BELLOWS VALVE No. 940013/3-CT-03

B.V. Job Ref: 3.30.1030.03

Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.

#1023-2 Gwanyang 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea

Manufacturer: SWI Valve Co. Ltd., Korea

(1) the addressee of the original of this certificate;

#### Description of the Supply / Subject of inspection:

**Product: Forged Steel Gate bellows Valve** 

Size of Tested Valve: 1"

Material of Tested Valve: ASTM A105N

Class of Tested Valve: #800 Stem Diameter: 11.1 mm Tightness class: AH

Endurance class: CO2(1500cycles)

Temperature class: t400°C

Valves Qualified according to sizes : up to 2" (Stem Dia. : 5.55 to 22.2 mm) Valves Qualified according to pressure ratings: #150, #300, #600, #800

Valves Qualified according to tightness class: AH

Valves Qualified according to Endurance class: CO2(1500cycles)

Valves Qualified according to temperature class : Room temperature to +400 ℃

This certificate covers the whole of the supply: 🗵 YES (no more inspection planned) 🗀 NO (part of the supply still to be inspected)

#### Scope of the B.V. Survey:

- Witness for Type Test of Fugitive Emission Test

#### This supply complies with the following applicable document (s): (2)

 ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.

#### List of enclosures: Test Report for Fugitive Emission Test ----- 9 Pages

(or reference to enclosed list)
The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.

#### Marking and Stamping on the items: None

#### Particulars or comments:

This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006.

Date of Issuance: 07-July-2010

Date of Inspection: 21 to 23-Jun-2010

issued by:

Validated by:

Name: K. M. Kim

Name: Y. M. N

Sign:

Sign:

Location of Inspection: BV-Korea, Seoul Office

This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Ventes

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.





#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

|   | REPORT.NO.  | SWI-FET-03   |  |  |  |  |  |
|---|-------------|--------------|--|--|--|--|--|
|   | ISSUED DATE | 05.July.2010 |  |  |  |  |  |
|   | CHECKED BY  | JONGWOO,SOHN |  |  |  |  |  |
| 1 | APPROVED BY | Yongpyo,Cho  |  |  |  |  |  |
|   |             |              |  |  |  |  |  |

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## PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 21<sup>ST</sup> June,2010 to 23<sup>RD</sup> June,2010

#### 1 VALVE SPECIFICATION

| Valve size & type  | GATE Bellows Valve A105N/13CRFS SW   |  |
|--------------------|--|--|
|                    | 800# WB RB 1"  |  |
| Material of Valve  | A105N  |  |
| Valve class        | 800#   |  |
| Stem diameter      | 11.1 mm  |  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing  Model No.: DAEWHA 6511+ 9001 |  |
|                    |  |  |
| Packing material   | Graphite , Graphite + Inconel Wire   |  |
| Operating torque   | 29 N/m   |  |
| Stroke / Angle     | 24.3 mm  |  |

#### 2TEST CONDITION

| Test pressure                 | 136-93bar  |                        |
|-------------------------------|--|------------------------|
| Test medium                   | He 99%   |                        |
| Check medium                  | He 99%   |                        |
| Test temperature              | RT/ 400°C  |                        |
| Test equipment                | Fugitive emission test equip, manufactured by SWI VALVE CO. LTD.  Helium Detector(ALCATEL Model ASM142 series) |                        |
|                               |  |                        |
| Leakage measurement equipment |  |                        |
| Sampling method               | Random   |                        |
| Valve repacking before test   | 0  | BUREAU VERITA          |
| Insulation of test valve      | Heating Jacket used  | WREVIEWED IN WITNESSED |
| Actuator                      | Geared motor   | BKMKmT                 |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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| - | APPROVED BY  | Yongpyo,Cho  |
|   |  |              |

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#### 3CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" +stem movement 8"+close 2") |

#### **4DOCUMENTATION USED**

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### **5TEST RESULTS**

Test results are recorded in manufactures test report from next page.





#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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|             |   |

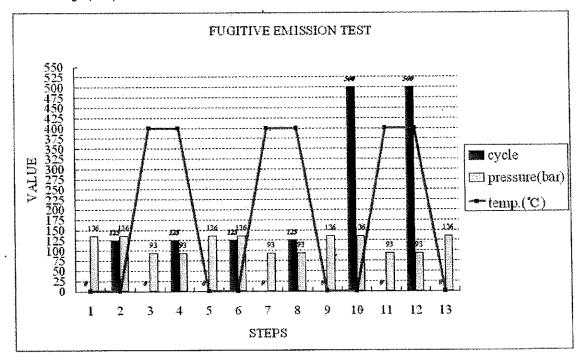
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**过REVIEWED** 

#### **6TEST STEPS**

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### 7 TEST TABLE

FORM-FET-01

The following table describes total of 13 steps and leakage rates in order.

TEST FROM ROOM TEMPERATURE(-29 ℃ ~+40 ℃) to +400 ℃.

#### Step 1, PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres. | (BAR) | Body          | Body-Bonnet  | Packing leakage         | Packing |
|-------|-------|---------------|--------------|-------------------------|---------|
| (BAR) |       | Temp.(°C)(°C) | Leakage(PPM) | (atm x cm³ x s³)        | torque  |
|       |       | •             |              |                         | Nm      |
| 136   |       | Room, Temp.   | 0            | 6.53 x10 <sup>-12</sup> | 35      |

#### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles Pres. (BAR) |     | Body Temp.(℃) | Packing leakage                            |
|---------------------------|-----|---------------|--|
|                           |     |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125                       | 136 | Room. Temp.   | 5.36 x10 <sup>-12</sup>                    |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|-------------|---------------|--|
|             | •             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93          | 400           | 1.32 x10 <sup>-12</sup>                    |

#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres. (BAR) | Body Temp.(*C) | Packing leakage                            |
|---------------|-------------|----------------|--|
|               | ,           |                | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 93          | 400            | 8.56 x10 <sup>-10</sup>                    |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|-------------|---------------|-------------------------|
|             |               | (atm x cm³ x s⁻¹)       |
| 136         | Room temp.    | 4.22 x10 <sup>-11</sup> |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| - | No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|---|---------------|-------------|---------------|-------------------------|
|   |               |             |               | (atm x cm³ x s⁻¹)       |
|   | 125           | 136         | Room. Temp.   | 6.89 x10 <sup>-11</sup> |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400°C

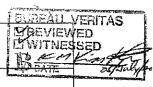
| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|-------------|---------------|--|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 93          | 400           | 8.36 x10 <sup>-11</sup>                    |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres. (BAR) . | Body Temp.(℃) | Packing leakage         |
|---------------|---------------|---------------|-------------------------|
|               |               |               | (atm x cm³ x s⁻¹)       |
| 125           | 93            | 400           | 3.23 x10 <sup>-10</sup> |

#### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(°C) | Packing leakage         |
|-------------|----------------|-------------------------|
|             |                | (atm x cm³ x s⁻¹)       |
| 136         | Room, Temp.    | 7.26 x10 <sup>-10</sup> |





#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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| APPROVED BY | Yongpyo,Cho  |  |
|             |              |  |
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#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage        |
|---------------|-------------|---------------|------------------------|
|               | •           |               | (atm x cm³ x s⁻¹)      |
| 500           | 136         | Room, Temp.   | 1,36 x10 <sup>-9</sup> |

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 $^\circ$ C

| Pres. (BAR) | Body Temp.(°C) | Packing leakage        |
|-------------|----------------|------------------------|
|             |                | (atm x cm³ x s⁻¹)      |
| 93          | 400            | 3.63 x10 <sup>-9</sup> |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 500           | 93          | 400           | 6.36 x10 <sup>-9</sup>                     |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres. (BAR) | Body Temp (℃) | Body-Bonnet  | Packing leakage                            |
|-------------|---------------|--------------|--|
|             |               | leakage(ppm) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 136         | Room Temp.    | 11           | 5.23 ×10 <sup>-8</sup>                     |

#### POST TEST EXAMINATION

No visible damage or wear on stem packing area

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WITNESSED
Date

SWI VALVE CO.LTD.



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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| CHECKED BY   | JongWoo,Sohn   |
| Approved By  | Yongpyo,Cho  |
|  |  |

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#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS A                    |
|---------------------------|----------------------------|
| Body & bonnet gasket seal | ≤50 ppmv                   |
| Stuffing box stem seal    | ≤10⁴(atm x cm³ x s⁻¹)      |
|                           | Equivalent to              |
|                           | ≤1.76x10³(atm x cm³ x s⁻¹) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal : stem diameter 11.1 mm

|                        | CLASS A   |
|------------------------|---|
| Stuffing box stem seal | Stem diameter (11.1mm) x 1.76x10 <sup>-8</sup>                        |
|                        | (atm x cm³ x s¹)  |
|                        | = 1.9536 x10 <sup>-7</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: AH** 

With no packing adjusted≤SSA0> for re tightening

#### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 400°C

Performance class : ISO FE AH- CO2 - SSA0 - t- (400 °C)-CL800- ISO 15848-1

BUREAU VERITAS
M REVIEWED
M WITNESSED

BOATE OSFOU Proto

| TEST CHECKED BY:                  | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| JONG WOO , SOHN                   | YONG PYO, CHO                       |
| 13                                | y p cho                             |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |





### TEST/INSPECTION CERTIFICATE

DATE: 2010.06.19

SWI ORDER NO.: SO20100300254

1023-2, Kwanyang-Dong, Dongan-Gu, Anyang, Kyunggi-Do, Korea. TEL: 82-31-422-7495/7 FAX: 82-31-422-7498

CERTIFICATE NO.

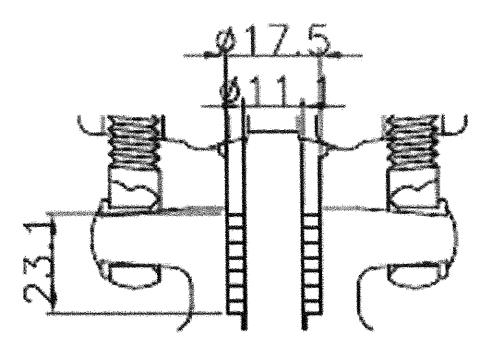
1003254

PROJECT NAME / NO: Fugitive Emission Test sample

Q.A Manager

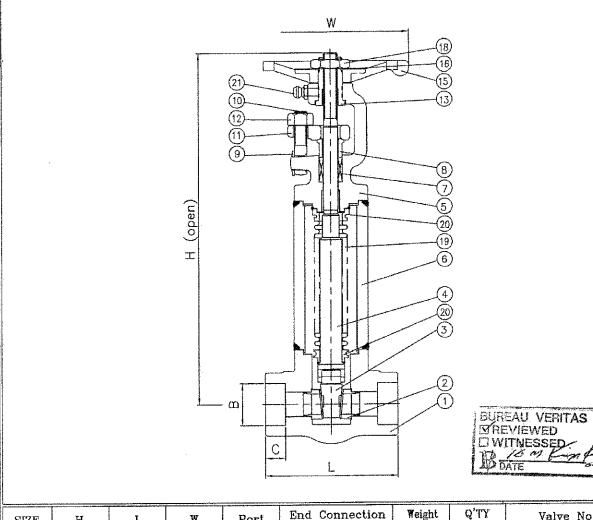
| NO.                     | ITEM DESCRIPTION   | Class<br>Press | SIZE   | Q'ty  | Hydro<br>(k | static Test<br>g/cm²) | Air Test<br>(kg/cm²) |   | Materials           | (ASTM)   |                       | Dimen<br>-sion | Inspe          | Functi<br>-onal | Result  |
|-------------------------|--|----------------|--------|-------|-------------|-----------------------|----------------------|---|---------------------|----------|-----------------------|----------------|----------------|-----------------|---------|
|                         |  | -ure           | (inch) | Se.cy | Shell       | Seat /<br>Backseat    | Seat                 | Body &<br>Bonnet  | Seat Ring<br>(Seat) | Stem     | Wedge/ Disc<br>(Ball) | Check          | -ction Te      | Test            | est     |
|                         | GATE BELLOWS V/V SW  | 800#           | 1"     | 1     | 210         | N/A                   | 6                    | A105N   | A276-410/HF         | A276-410 | A217-CA15/HF          | GOOD           | GOOD           | GOOD            | ACCEPTE |
| labella: stat ( ** s ** |  |                |        |       |             |                       |                      | J. JANUARY 11 A. M. |                     |          |                       |                |                |                 |         |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       |                |                |                 |         |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       |                |                |                 |         |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       |                |                |                 |         |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       |                |                |                 |         |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       | 32             | ZAEAU<br>REVIE | VERITA<br>VED   | S       |
|                         |  |                |        |       |             |                       |                      |   |                     |          |                       |                | WITNE<br>BASE  | SSED            | to      |
|                         | A particular and the second se |                |        |       |             |                       |                      |   |                     |          |                       | 1.20           | 7 1/4 1 5      |                 | 63/     |
|                         |  |                |        |       |             |                       |                      |   |                     |          | essed / Review        |                |                |                 |         |

WE HEREBY CERTIFY THAT THE RESULTS MENTIONED ABOVE ARE TRUE AND CORRECT IN EVERY DETAIL



**Bellows** Gate

BUREAU VERITAS
MEVIEWED
WITNESSED
DATE



| OF  | RDER NO. :    |                          |                              |
|-----|---------------|--------------------------|------------------------------|
| В   | ILL OF        | MATERIALS                | 5                            |
| NO. | PARTS         | MATERIALS                | ASTM                         |
| 1   | Body          | Forged Steel             | A105                         |
| 2   | Seat Ring     | 13Cr Stoinless Steel     | A276-410                     |
|     | Wedge         | 13Cr Stainless Steel     | A743-CA40                    |
| 4   | Stem          | 13Cr Stainless Steel     | A276-410                     |
| 5   | Bonnet        | Forged Steel             | A105                         |
| 6   | Connector     | Carbon Steel             | A105/A106-B                  |
| 7   | Gland Packing | Graphite + Carbon Fiber  |                              |
| 8   | Gland         | Stainless Steel          | A276-304                     |
| 9   | Ret. Washer   | Stoinless Steel          | A276-304                     |
| 10  | Eye Bolt      | Stainless Steel          | A276-304                     |
| 11  | Gland Flange  | Forged Steel             | A105                         |
| 12  | Gland Nut     | Carbon Steel             | A194-2H                      |
| 13  | Yoke Sleeve   | 13Cr Stainless Steel     |                              |
| 15  | Handwheel     | Malleable Iron           | A47                          |
| 16  | Name Plate    | Aluminum                 |                              |
| 18  | Handwheel Nut | Carbon Steel             | A563A                        |
| 19  | Bellows       | Stainless Steel          | 321SS                        |
| 20  | End Fitting   | Stainless Steel          | 316SS                        |
| 21  | Grease Nipple | Corbon Steel + Cr Plated |                              |
|     |               |                          |                              |
|     |               |                          |                              |
|     |               |                          |                              |
|     |               | Shell : 2975 Ps          | ( 209.5 Kg/Cm <sup>2</sup> ) |
| Hy  | draulic Test  | Back Seat : 2175 Ps      | ( 153 Kg//Cm <sup>2</sup> )  |
| Pn  | eumatic Test  | Seat : 80 Ps             |                              |
| Sea | at Ring       | Stellited (#6)           |                              |
| Wee | dge           | Stellited (#6)           |                              |
| Val | ve Finishing  | Phosphatized             |                              |
|     | d Connection  |                          | I B 16.11)                   |
|     | ۲             |                          | T T                          |

| SIZE   | Н      | L   | W   | Port | End Cor | nection | Weight | Q'TY  | Valve No. |
|--------|--------|-----|-----|------|---------|---------|--------|-------|-----------|
| (Inch) | (Open) |     | -,  | Dia. | В       | C       | (Kg)   | (pcs) |           |
| 1/2    | 226    | 76  | 102 | 9.5  | 21.8    | 10      | 2.4    |       |           |
| 3/4    | 243    | 86  | 102 | 12.7 | 27.2    | 13      | 3.1    |       |           |
| 11     | 306    | 102 | 114 | 18.0 | 33.9    | 13      | 4.0    |       |           |
| 1-1/4  | 395    | 117 | 140 | 31.0 | 42.7    | 13      | 8.1    |       |           |
| 1-1/2  | 395    | 117 | 140 | 31.0 | 48.8    | 13      | 8,1    |       |           |
| 2      | 459    | 133 | 165 | 37.0 | 61.2    | 16      | 12.9   |       |           |

Rev. No. TITLE FORGED STEEL BELLOWS GATE VALVE CLASS 800 WB OS & Y S.W REDUCED PORT

Description

REV'D

APP'D

| _ | L        |          |          |          |            |             |
|---|----------|----------|----------|----------|------------|-------------|
|   | Refer to | API 602  | Fig No.  |          | D.W.G. No. | 07112751-01 |
|   | Drawn by | I.C.JUNG | Chk'd by | K.H.JUNG |            | H.G.PARK    |
| J |          |          |          |          |            |             |

CLIENT :

S W I Valve Co., Ltd.



**Energy & Process** 

#### TYPE APPOROVAL CERTIFICATE FOR GLOBE BELLOWS VALVE No. 940013/3-CT-04

B.V. Job Ref: 3.30.1030.03

Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.

#1023-2 Gwanyang 1-dong,Dongan-gu, Anyang-si, Gyeonggi-do, Korea

Manufacturer: SWI Valve Co. Ltd., Korea

(1) the addressee of the original of this certificate:

#### Description of the Supply / Subject of Inspection:

**Product: Forged Steel Globe bellows Valve** 

Material of Tested Valve: ASTM A105N

Size of Tested Valve: 1" Class of Tested Valve: #800 Stem Diameter: 12.7 mm

Tightness class: AH

Endurance class: CO2(1500cycles)

Temperature class: t400 °C

Valves Qualified according to sizes: up to 2" (Stem Dia.: 6.35 to 25.4mm) Valves Qualified according to pressure ratings: #150, #300, #600, #800

Valves Qualified according to tightness class: AH

Valves Qualified according to Endurance class: CO2(1500cycles)

Valves Qualified according to temperature class : Room temperature to +400 ℃

This certificate covers the whole of the supply: 🔯 YES (no more inspection planned) 🔲 NO (part of the supply still to be inspected)

#### Scope of the B.V. Survey:

- Witness for Type Test of Fugitive Emission Test

#### This supply complies with the following applicable document (s): (2)

 ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.

#### List of enclosures: Test Report for Fugitive Emission Test ----- 9 Pages

(or reference to enclosed fist)
The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.

#### Marking and Stamping on the items: None

#### Particulars or comments:

This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006.

Õ

SEOUL

Date of Issuance: 07-July-2010 Date of Inspection: 24 to 26-Jun-2010 Issued by:

Validated by:

Name: K. M. Kin

Name: Y. M. V

Location of Inspection: BV-Korea, Seoul Office

This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Veritas Ce Certificat est délivre dans le cadre des Conditions Générales de Sérvice du Bureau Veritas

This certificate is issued further to an Inspection whose duration and scope were limited by the terms and conditions of the contract with 8V principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety,

performance in operation and/or reliability.



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

|       | REPORT.No.  | SWI-FET-04   |
|-------|-------------|--------------|
| 1     | ISSUED DATE | 05.July.2010 |
| ***** | Снескед Ву  | JongWoo,Sohn |
| •     | APPROVED BY | Yongpyo,Cho  |
|       |             |              |

Page 1 of 6

# PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 24<sup>th</sup> June,2010 to 26<sup>th</sup> June,2010

#### 1 VALVE SPECIFICATION

| Valve size & type  | GLOBE Bellows Valve A105N/13CRFS                 |  |  |
|--------------------|--|--|--|
|                    | SW 800# WB RB 1"                                 |  |  |
| Material of Valve  | A105N  |  |  |
| Valve class        | 800#   |  |  |
| Stem diameter      | 12.7 mm  |  |  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |  |  |
|                    | Model No. : DAEWHA 6511+ 9001                    |  |  |
| Packing material   | Graphite , Graphite + Inconel Wire               |  |  |
| Operating torque   | 32 N/m   |  |  |
| Stroke / Angle     | 7.8mm  |  |  |

#### 2TEST CONDITION

| Test pressure                 | 136-93bar  |                     |  |  |
|-------------------------------|--|---------------------|--|--|
| Test medium                   | He 99%   |                     |  |  |
| Check medium                  | He 99%   |                     |  |  |
| Test temperature              | RT/ 400°C  |                     |  |  |
| Test equipment                | Fugitive emission test equip. manufactured by SWI VALVE CO. LTD. |                     |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL M  | odel ASM142 series) |  |  |
| Sampling method               | Random   |                     |  |  |
| Valve repacking before test   | 0  | BUREAU VERI         |  |  |
| Insulation of test valve      | Heating Jacket used  | <b>■</b> REVIEWED   |  |  |
| Actuator                      | Geared motor   | B E DATE            |  |  |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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|--|--|
| REPORT.No.   | SWI-FET-04   |
| Issued Date  | 05.July.2010   |
| CHECKED BY   | JongWoo,Sohn   |
| APPROVED BY  | Yongpyo,Cho  |
|  |  |

Page 2 of 6

#### 3CONDITION FOR CYCLING TEST

| Number of step test cycles                | 4   |
|---|---|
| Number of cycles for step                 | 125   |
| Number of step test cycles                | 2   |
| Number of cycles for step                 | 500   |
| Number of step cycles at high temperature | 3   |
| The duration of the cycle stroke          | 14sec. (open 2" +stem movement 8"+close 2") |

#### 4DOCUMENTATION USED

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### **5TEST RESULTS**

Test results are recorded in manufactures test report from next page.

BUREAU VERITAS
EREVIEWED
EWITNESSED
DATE



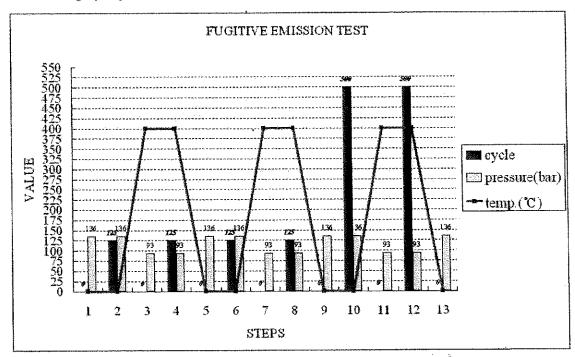
#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No.  | SWI-FET-04   |
|-------------|--------------|
| ISSUED DATE | 05.July,2010 |
| CHECKED BY  | JONGWOO,SOHN |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### 6 TEST STEPS

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### 7 TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

BUREAU VERITAS
WEEVIEWED
WITNESSED
DATE

#### Step1 PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR)                             | Body Temp.(°C) | Body-Bonnet  | Packing leakage                            | Packing |
|--|----------------|--------------|--|---------|
| ************************************** |                | Leakage(PPM) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | torque  |
| •                                      |                |              |  | (Nm)    |
| 136                                    | Room, Temp.    | 0            | 5.36 x10 <sup>-12</sup>                    | 37      |

#### Step2.MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. | Body Temp.(℃) | Packing leakage<br>(atm x cm³ x s⁻¹) |
|---------------|-------|---------------|--------------------------------------|
| 125           | 136   | Room. Temp.   | 8.36 x10 <sup>-11</sup>              |

FORM-FET-01 SWI VALVE CO.LTD.



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No.  | SWI-FET-04   |
|-------------|--------------|
| Issued Date | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### Step3.STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |  |
|------------|---------------|--|--|
|            | ,             | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |
| 93         | 400           | 4,36 x10 <sup>-12</sup>                    |  |

#### Step4.MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage         |
|---------------|------------|---------------|-------------------------|
|               | ,          |               | (atm x cm³ x s⁻¹)       |
| 125           | 93         | 400           | 5.63 x10 <sup>-11</sup> |

#### Step5.INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | lody Temp.(°C) Packing leakage |                         |
|------------|--------------------------------|-------------------------|
|            |                                | (atm x cm³ x s⁻¹)       |
| 136        | Room. Temp.                    | 4.59 x10 <sup>-11</sup> |

#### Step6.MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|------------|---------------|--|
|               |            |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 136        | Room. Temp,   | 9.62 x10 <sup>-11</sup>                    |

#### Step7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 °C

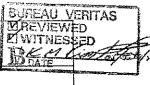
| Pres.(BAR) | Body Temp.(℃) | Packing leakage         |  |
|------------|---------------|-------------------------|--|
|            |               | (atm x cm³ x s⁻¹)       |  |
| 93         | 400           | 8.36 x10 <sup>-11</sup> |  |

#### Step8 MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| No. of Cycles | Pres.(BAR) . | Body Temp.(℃) | Packing leakage                            |
|---------------|--------------|---------------|--|
|               |              |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 93           | 400           | 7.36 x10 <sup>-10</sup>                    |

#### Step9.INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres.(BAR) | Body Temp.(℃) | Packing leakage         |  |
|------------|---------------|-------------------------|--|
|            |               | (atm x cm³ x s⁻¹)       |  |
| 136        | Room, Temp.   | 1.25 x10 <sup>-11</sup> |  |





#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.No.  | SWI-FET-04   |
|-------------|--------------|
| ISSUED DATE | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| APPROVED BY | Yongpyo,Cho  |
|             |              |

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#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage         |
|---------------|------------|---------------|-------------------------|
|               | •          |               | (atm x cm³ x s⁻¹)       |
| 500           | 136        | Room. Temp.   | 6.82 x10 <sup>-10</sup> |

#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 400 °C

| Pres.(BAR) | Body Temp.(℃) | Packing leakage         |
|------------|---------------|-------------------------|
|            | *             | (atm x cm³ x s⁻¹)       |
| 93         | 400           | 7.28 x10 <sup>-10</sup> |

#### Step 12.MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 400 ℃

| No. of Cycles | Pres.(BAR) | Body Temp.(℃) | Packing leakage        |
|---------------|------------|---------------|------------------------|
|               |            |               | (atm x cm³ x s⁻¹)      |
| 500           | 93         | 400           | 9.25 x10 <sup>-9</sup> |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres.(BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage                            |
|------------|---------------|--------------|--|
|            |               | leakage(ppm) | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 136        | Room Temp.    | 12           | 1.23 x10 <sup>-9</sup>                     |

#### POST TEST EXAMINATION

No visible damage or wear on stem packing area



SWI VALVE CO.LTD.

FORM-FET-01



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.NO.  | SWI-FET-04   |  |  |  |  |
|-------------|--------------|--|--|--|--|
| ISSUED DATE | 05.July.2010 |  |  |  |  |
| Снескед Ву  | JongWoo,Sohn |  |  |  |  |
| APPROVED BY | Yongpyo,Cho  |  |  |  |  |
|             |              |  |  |  |  |

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#### ACCEPTANCE TIGHTNESS CLASS

| -                         | CLASS A   |
|---------------------------|---|
| Body & bonnet gasket seal | ≤50 ppmv  |
| Stuffing box stem seal    | ≤10°(mg x s⁻¹ x m⁻¹)  |
|                           | Equivalent to   |
|                           | ≤1.76x10 <sup>-8</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal : stem diameter 12,7 mm

|                        | CLASS A  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter (12.7mm) x 1.76x10 <sup>-6</sup>           |
|                        | (atm x cm³ x s⁻¹)  |
|                        | = $2.235 \times 10^{-7} (atm \times cm^3 \times s^{-1})$ |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: AH** 

With no packing adjusted ≤SSA0>for re tightening

#### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 400 ℃

Performance class: ISO FE AH- CO2 - SSA0 - t- (400 °C)-CL800- ISO 15848-1

TEST CHECKED BY: TEST APPROVED BY:

JONG WOO, SOHN
YONG PYO, CHO

DATE: July 5<sup>TH</sup>, 2010

DATE: July 5<sup>TH</sup>, 2010





## TEST/INSPECTION CERTIFICATE

DATE: 2010, 06, 23

SWI ORDER NO.: \$020100300254

CERTIFICATE NO.

1003254

PROJECT NAME / NO: Fugitive Emission Test sample

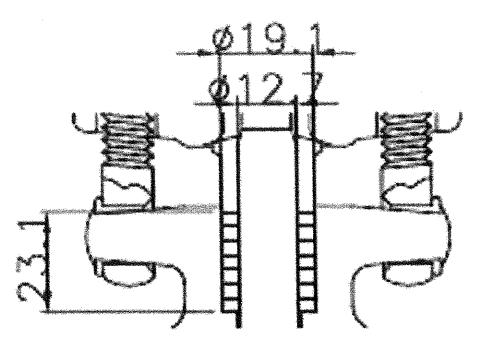
1023-2, Kwanyang-Dong, Dongan-Gu, Anyang, Kyunggi-Do, Korea. TEL: 82-31-422-7495/7 FAX: 82-31-422-7498

CUSTOMER/CLIENT : SWI Valve co. Ltd.

PONO.:

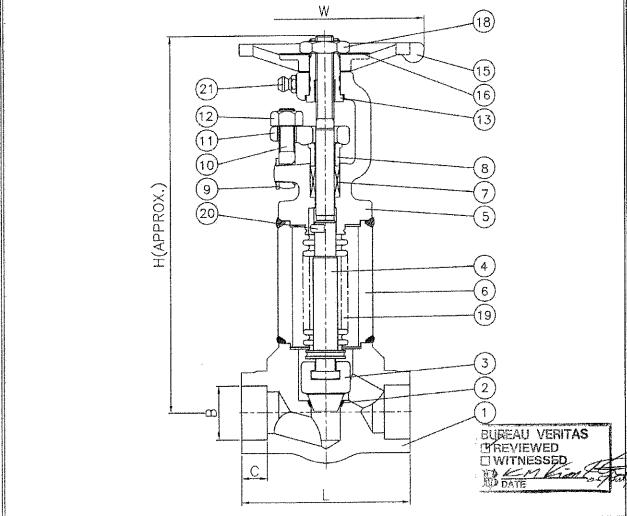
|        | TEN DESCRIPTION  | Class<br>Press   | SIZE   | Q'ty  | Hydro<br>(k | static Test<br>g/cm²) | Air Test<br>(kg/cm²) |                  | Materials  | (ASTM)   |  |          | -onal               | nai Result   |                                       |
|--------|--|--|--------|-------|-------------|-----------------------|----------------------|------------------|--|----------|--|----------|---------------------|--|---------------------------------------|
| NO.    | ITEM DESCRIPTION   | -ure   | (inch) | Giy   | Shell       | Seat /<br>Backseat Se | Seat                 | Body &<br>Bonnet | Seat Ring<br>(Seat)  | Stem     | Wedge/ Disc<br>(Ball)  | Check    | -ction              | Test   |                                       |
|        | GLOBE BELLOWS V/V SW   | 800#   | 1"     | 1     | 210         | 153/N.A               | N/A                  | A105N            | A276-410/HF  | A276-410 | A217-GA15/HF   | GOOD     | GOOD                | GOOD   | ACCEPTED                              |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          |                     | ····   |                                       |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          |                     |  |                                       |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          | ļ                   |  |                                       |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          |                     |  |                                       |
| ,      |  |  |        |       |             |                       |                      |                  |  |          |  |          |                     |  |                                       |
|        | And the second of the second o | A CONTRACTOR OF THE PROPERTY O |        |       |             |                       |                      |                  |  |          |  |          |                     |  |                                       |
| ······ |  |  |        |       |             |                       |                      |                  |  |          |  |          |                     | <del> </del>   |                                       |
|        |  |  |        |       |             |                       |                      |                  |  |          |  | <u> </u> | ACT TO SERVED STORY | 1  | 17424                                 |
|        |  |  |        |       |             |                       |                      |                  |  |          |  | 1        | iseau<br>Reviev     | VERITA<br>ED<br>SE <b>D</b>  | S                                     |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          | WITNE               | SEP  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
|        |  |  |        |       |             |                       |                      |                  |  |          |  |          | K                   | 93   |                                       |
|        | A MARKA  |  |        |       |             |                       |                      |                  |  |          |  | <u> </u> |                     |  |                                       |
|        |  |  |        |       |             |                       |                      |                  |  |          | THE RESERVE AND ADDRESS OF THE PERSON NAMED AND ADDRESS OF THE |          |                     |  |                                       |
|        | 1. These standard for inspecti<br>2. HF: STELLITE NO. 6 Hard   | on conform   | to API | 598   |             |                       |                      |                  |  | Witne    | essed / Review   | ed by C  | ustome              | г кер.   |                                       |
| ks     | Z, Mr : STELLITE NO. 6 Maio  | racing.  |        |       |             |                       |                      |                  |  | 4        |  |          |                     |  |                                       |
|        |  |  |        |       |             |                       |                      |                  | AND THE REAL PROPERTY OF THE PARTY OF THE PA | Q.A.I    | Vlanager   | 1 P      |                     |  | <i>A</i>                              |
|        | HEREBY CERTIFY THAT TH   | IE DESHI   | TCME   | NTION | IED AR      | OVE ARE               | TRUE AN              | D CORRFC         | T IN EVERY DE  | TAIL     |  |          | 12                  | A STATE OF THE STA | 100_                                  |

SWI-FORM QA-013



Bellows Globe

BUREAU VERITAS
PREVIEWED
WITNESSED
DATE



|  | SIZE   | н      | Т.  | w   | Port | End Cor | nection | Weight | Q'TY  | Tag No.  |
|--|--------|--------|-----|-----|------|---------|---------|--------|-------|----------|
|  | (Inch) | (Open) |     | ,,, | Dia. | B       | C       | (Kg)   | (pcs) | <u> </u> |
| and the state of t | 1/2    | 202    | 76  | 102 | 9.5  | 21.8    | 10      | 2.1    | 17    |          |
|  | 3/4    | 202    | 86  | 102 | 12.7 | 27.2    | 13      | 2.6    | 5     |          |
| <u>k</u>   | 1      | 233    | 102 | 114 | 17.5 | 33.9    | 13      | 3.4    | 88    |          |
| /  | 1-1/2  | 269    | 152 | 140 | 29.5 | 48.8    | 13      | 7.0    | 3     |          |
|  | 2      | 351    | 172 | 165 | 35.0 | 61.2    | 16      | 11.7   | 43    |          |

|     | ORDER NO. :                                      |               |                          |                      |  |  |  |
|-----|--|---------------|--------------------------|----------------------|--|--|--|
|     | В  | ILL OF        | MATERIAL                 | S                    |  |  |  |
| Ī   | Ю.   | PARTS         | MATERIALS                | А                    | ASTM                                   |  |  |
| -   | 1  | Body          | Forged Steel             | A105                 |  |  |  |
| 1   | 2  | Seat          | Stellite Hardfacing      |                      |  |  |  |
|     | 3  | Disc          | 13Cr Stainless Steel     | A276                 | -410                                   |  |  |
|     | 4  | Stem          | 13Cr Stainless Steel     | A276-                | -410                                   |  |  |
|     | 5  | Bonnet        | Forged Steel             | A105                 |  |  |  |
|     | б  | Connector     | Carbon Steel             |                      | /A106-B                                |  |  |
|     | 7  | Gland Packing | Graphite + Carbon Fib    |                      |  |  |  |
|     | 8  | Gland         | Stainless Steel          | A276                 | -304                                   |  |  |
|     | 9  | Ret. Washer   | Stainless Steel          | A276                 |  |  |  |
| F L | 0  | Eye Bolt      | Stainless Steel          | A276                 | -304                                   |  |  |
| 1   | 1  | Gland Flange  | Forged Steel             | A105                 |  |  |  |
|     | 2  | Gland Nut     | Carbon Steel             | A194                 |  |  |  |
|     | 3  | Yoke Sleeve   | 13Cr Stainless Steel     | A276                 | -410                                   |  |  |
|     | 5  | Handwheel     | Malleable Iron           | A47                  |  |  |  |
| 1   | 6  | Name Plate    | Stainless Plate          |                      | A240-304                               |  |  |
|     | 8  | Hondwheel Nut | Carbon Steel             | A563/                |  |  |  |
| 7   | 9  | Bellows       | Stainless Steel          | 3215                 |  |  |  |
|     | 20   | Guide Pin     | 13Cr Stoinless Steel     | A276                 | -410                                   |  |  |
| 2   | 21   | Grease Nipple | Carbon Steel + Or Plated |                      | ······································ |  |  |
|     |  |               |                          |                      |  |  |  |
|     |  |               |                          |                      |  |  |  |
|     |  |               |                          |                      |  |  |  |
|     |  |               |                          | <sup>2</sup> si( 210 | Kg//Cm²)                               |  |  |
| 11  | Hve  | draulic Test  | Back Seat: 2175 F        | <sup>2</sup> sí( 153 | Kg//Cm²)                               |  |  |
|     | •  |               | Seat : 2175 F            | <sup>2</sup> si( 153 | Kg//Cm <sup>2</sup> )                  |  |  |
|     | Seat of Body Disc Valve Finishing End Connection |               | Hardfaced with Stelli    | te #6 on             | Body                                   |  |  |
|     |  |               | Stellited (#6)           |                      |  |  |  |
|     |  |               | Phosphatized             |                      |  |  |  |
|     |  |               | Socket Weld (AN          | SI B16.              | 11)                                    |  |  |
|     |  | 3             |                          |                      |  |  |  |
| 北   |  | 2             |                          |                      |  |  |  |
| ∦   | s  | 1.            |                          |                      |  |  |  |
|     | ₹ev  | No. De        | escription               | REV'D                | APP'D                                  |  |  |
| Ī   | m  | F nongen om   | TO DELLOWE OF            | ODE UA               | T 1/162                                |  |  |

TITLE FORGED STEEL BELLOWS GLOBE VALVE CLASS 800 WB OS & Y S.W REDUCED PORT

| Refer to | API 602 / BS5352 | Fig No.  |          | D.W.G. No. | 04033053-01 |
|----------|------------------|----------|----------|------------|-------------|
| Drown by | J.E.PARK         | Chk'd by | K.H.JUNG | App d by   | H.G.PARK    |
|          |                  |          |          |            |             |

CLIENT :





**Energy & Process** 

# TYPE APPOROVAL CERTIFICATE FOR 2-P TRUNNION BALL VALVE No. 940013/3-CT-05

B.V. Job Ref: 3,30,1030,03

Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.

#1023-2 Gwanyang 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea

Manufacturer: SWI Valve Co. Ltd., Korea

(1) the addressee of the original of this certificate;

#### Description of the Supply / Subject of inspection:

Product : Cast Steel 2-P Trunnion Ball Valve

Material of Tested Valve: ASTM A216-WCB

Size of Tested Valve : 4" Class of Tested Valve : #600 Stem Diameter : 36,0 mm Tightness class : AH

Endurance class: CO2(1500cycles)

Temperature class: t200°C

Valves Qualified according to sizes : up to 16" (Stem Dia. : 18 to 72mm) Valves Qualified according to pressure ratings : #150 , #300 , #600

Valves Qualified according to tightness class: AH

Valves Qualified according to Endurance class: CO2(1500cycles)

Valves Qualified according to temperature class : Room temperature to + 200 ℃

This certificate covers the whole of the supply: 🔯 YES (no more inspection planned) 🔲 NO (part of the supply still to be inspected)

#### Scope of the B.V. Survey:

- Witness for Type Test of Fugitive Emission Test

#### This supply complies with the following applicable document (s): (2)

- ISO 15848-1 Industrial Valves-Measurement, Test and Qualification Procedure for Fugitive Emission (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.

#### List of enclosures: Test Report for Fugitive Emission Test ----- 10 Pages

(or reference to enclosed list)

The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.

#### Marking and Stamping on the items: None

#### Particulars or comments:

This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactory in The Fugitive Emission Test in accordance with ISO 15848-1 Edition 2006.

Date of Issuance: 07-July-2010

issued by :

Sign:

Date of Inspection: 28 to 30-Jun-2010

Name : K. M. Kim

Validated by : Name : Y M Moor

., ....

Location of Inspection: BV-Korea, Seoul Office

Name : Y. M. Moon

Sign:

This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Ventes Ce Certificat est délivré dans le cadre des Conditions Générales de Service du Bureau Ventas

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.

F SEOUL)



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| * | REPORT.NO.  | SWI-FET-05    |  |  |  |  |  |
|---|-------------|---------------|--|--|--|--|--|
|   | ISSUED DATE | 05. July.2010 |  |  |  |  |  |
|   | CHECKED BY  | JONGWOO,SOHN  |  |  |  |  |  |
|   | Approved By | Yongpyo,Cho   |  |  |  |  |  |
|   |             |               |  |  |  |  |  |

Page 1 of 6

## PROTOTYPE TEST FOR VALVE ACCORDING TO ISO 15848-1 Edition 2006

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 28th June,2010 to 30th June,2010

#### 1 VALVE SPECIFICATION

| Valve size & type  | 2P-TRUNNION BALL VALVE WCB/316+RTFE |
|--------------------|-------------------------------------|
|                    | RF FB 600# 4"                       |
| Material of Valve  | A216-WCB                            |
| Valve class        | 600#                                |
| Stem diameter      | 36.0 mm                             |
| Gland packing type | Graphite Molded Packing             |
| Packing material   | FKM+Graphite                        |
| Operating torque   | 396 N/m                             |
| Stroke/ Angle      | Quarter-turn                        |

#### 2TEST CONDITION

| Test pressure  | 102-88 bar                                   | 102-88 bar |  |  |  |  |
|--|--|------------|--|--|--|--|
| Test medium  | He 99%                                       |            |  |  |  |  |
| Check medium   |  |            |  |  |  |  |
| Test temperature   | RT/ 200°C                                    |            |  |  |  |  |
| est equipment Fugitive emission test equip. manufactu SWI VALVE CO. LTD. |  |            |  |  |  |  |
| Leakage measurement equipment  | Helium Detector(ALCATEL Model ASM142 series) |            |  |  |  |  |
| Sampling method  | Random                                       |            |  |  |  |  |
| Valve repacking before test  | 0  |            |  |  |  |  |
| Insulation of test valve   | Heating Jacket used BUREAU                   |            |  |  |  |  |
| Actuator   | Geared motor                                 |            |  |  |  |  |

DATE



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| - |             |               |  |  |  |  |
|---|-------------|---------------|--|--|--|--|
|   | REPORT.No.  | SWI-FET-05    |  |  |  |  |
|   | ISSUED DATE | 05. July.2010 |  |  |  |  |
|   | Снескед Ву  | JONGWOO,SOHN  |  |  |  |  |
| _ | Approved By | Yongpyo, Cно  |  |  |  |  |
|   |             |               |  |  |  |  |

Page 2 of 6

#### **3CONDITION FOR CYCLING TEST**

| Number of step test cycles                | 4  |
|---|--|
| Number of cycles for step                 | 125  |
| Number of step test cycles                | 2  |
| Number of cycles for step                 | 500  |
| Number of step cycles at high temperature | 3  |
| The duration of the cycle stroke          | 14sec. (open 2sec. +stem movement 8sec.+close 2sec.) |

#### **4DOCUMENTATION USED**

Industrial Valves- Measurement test and qualification procedures for fugitive emission Spec. ISO 15848-1 Edition 2006.

#### **5TEST RESULTS**

Test results are recorded in manufactures test report from next page.

BUREAU VERITAS

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BOATE

SWI VALVE CO.LTD.



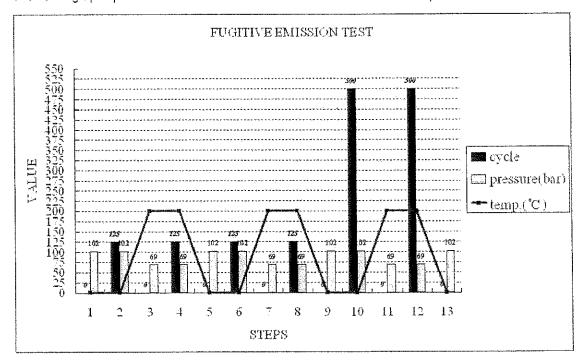
#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| REPORT.NO.  | SWI-FET-05    |
|-------------|---------------|
| ISSUED DATE | 05. July.2010 |
| CHECKED BY  | JongWoo,Sohn  |
| APPROVED BY | Yongpyo,Cho   |

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#### **6TEST STEPS**

The below graph specifies fluctuation of the 3 factors over total of 13 test steps.



#### 7 TEST TABLE

The following table describes total of 13 steps and leakage rates in order.

# BUREAU VERITAS PREVIEWED WITNESSED

#### TEST FROM ROOM TEMPERATURE TO +200℃

#### Step 1. PRELIMINERY TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet<br>Leakage(PPM) | Packing leakage (atm x cm <sup>3</sup> x s <sup>-1</sup> ) | Packing<br>torque |
|-------------|---------------|-----------------------------|--|-------------------|
|             |               |                             |  | Nm                |
| 102         | Room, Temp.   | 0                           | 5.125 x 10 <sup>-12</sup>                                  | 53                |

#### Step 2. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|---------------|-------------|---------------|--|
|               |             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 125           | 102         | Room, Temp,   | 4.336x10 <sup>-11</sup>                    |

#### Step 3. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200°C

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|-------------|---------------|--|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 88          | 200           | 4.216 x10 <sup>-11</sup>                   |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| ц |             |               |
|---|-------------|---------------|
|   | REPORT.No.  | SWI-FET-05    |
|   | Issued Date | 05, July,2010 |
|   | CHECKED BY  | JongWoo,Sohn  |
| 1 | APPROVED BY | Yongpyo,Cho   |
|   |             |               |

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#### Step 4. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200 °C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|---------------|-------------|---------------|-------------------------|
|               |             |               | (atm x cm³ x s⁻¹)       |
| 125           | 69          | 200           | 3.21 x10 <sup>-10</sup> |

#### Step 5. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|-------------|---------------|-------------------------|
|             |               | (atm x cm³ x s⁻¹)       |
| 102         | Room, Temp.   | 4.23 x10 <sup>-11</sup> |

#### Step 6. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage          |
|---------------|-------------|---------------|--------------------------|
|               |             |               | (atm x cm³ x s⁻¹)        |
| 125           | 102         | Room, Temp.   | 2.156 x10 <sup>-11</sup> |

#### Step 7. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200 ℃

| Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|-------------|---------------|-------------------------|
|             |               | (atm x cm³ x s⁻¹)       |
| 88          | 200           | 9.53 x10 <sup>-11</sup> |

#### Step 8. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200°C

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage         |
|---------------|-------------|---------------|-------------------------|
|               |             |               | (atm x cm³ x s⁻¹)       |
| 125           | 69          | 200           | 6.23 x10 <sup>-10</sup> |

#### Step 9. INTERMEIATE STATIC TESTS AT THE ROOM TEMPERATURE

| Pres. (BAR) | Body Temp.(℃) | Packing leakage                            |
|-------------|---------------|--|
|             |               | (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |
| 102         | Room. Temp.   | 5.112 x10 <sup>-11</sup>                   |
| <u> </u>    |               |  |

# BUREAU VERITAS PREVIEWED PWITNESSED

#### Step 10. MECHANICAL CYCLE TEST AT THE ROOM TEMPERATURE

| No. of Cycles | Pres. (BAR) | Body Temp.(℃) | Packing leakage                             |  |  |
|---------------|-------------|---------------|---|--|--|
|               |             |               | ((atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |  |
| 500           | 102         | Room. Temp.   | 8.42 x10 <sup>-9</sup>                      |  |  |



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

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|---|-------------|---------------|
|   | ISSUED DATE | 05. JULY.2010 |
|   | Снескер Ву  | JongWoo,Sohn  |
| - | APPROVED BY | Yongpyo,Cho   |
|   |             |               |

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#### Step 11. STATIC TEST AT THE SELECTED TEST TEMPERATURE 200 ℃

| Pres. (BAR) | Body Temp.(℃) | Packing leakage(atm x cm <sup>3</sup> x s <sup>-1</sup> ) |  |
|-------------|---------------|---|--|
| 88          | 200           | 6.65 x10 <sup>-10</sup>                                   |  |

#### Step 12. MECHANICAL CYCLE TEST AT THE SELECTED TEST TEMPERATURE 200 ℃

| No. of Cycles | Pres. (BAR) | Body Temp.(°C) | Packing leakage<br>(atm x cm³ x s⁻¹) |
|---------------|-------------|----------------|--------------------------------------|
| 500           | 69          | 200            | 4.23 ×10 <sup>-9</sup>               |

#### Step 13. FINAL TEST AT THE ROOM TEMPERAURE

| Pres. (BAR) | Body Temp.(℃) | Body-Bonnet  | Packing leakage        |  |  |
|-------------|---------------|--------------|------------------------|--|--|
|             |               | leakage(PPM) | (atm x cm³ x s⁻¹)      |  |  |
| 102         | Room Temp.    | 15           | 4.35 x10 <sup>-9</sup> |  |  |

#### POST TEST EXAMINATION

No visible damage and wear on stem packing area

BUREAU VERITAS

PREVIEWED

WITNESSED

DATE

SWI VALVE CO.LTD.

FORM-FET-01



#### FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < ISO 15848-1 >

| Iss<br>Cr | REPORT.NO.  | SWI-FET-05    |
|-----------|-------------|---------------|
|           | ISSUED DATE | 05. July,2010 |
|           |             | JongWoo,Sohn  |
|           | APPROVED BY | Yongpyo,Сно   |
|           |             |               |

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#### ACCEPTANCE TIGHTNESS CLASS

|                           | CLASS A   |
|---------------------------|---|
| Body & bonnet gasket seal | ≤50 ppmv  |
| Stuffing box stem seal    | ≤10*(mgxs <sup>-1</sup> xm <sup>-1</sup> )                        |
|                           | Equivalent to   |
|                           | ≤1.76x10 <sup>-6</sup> (atm x cm <sup>3</sup> x s <sup>-7</sup> ) |

Maximum allowable tightness leakages based on actual dimensions of stuffing box packing seals with:

- stuffing box packing seal ; stem diameter 36.0 mm

|                        | CLASS A  |
|------------------------|--|
| Stuffing box stem seal | Stem diameter( 36.0mm )x1.76x 10 <sup>-8</sup>                       |
|                        | (atm x cm³ x s¹)   |
|                        | = 6.336 x10 <sup>-7</sup> (atm x cm <sup>3</sup> x s <sup>-1</sup> ) |

Conclusion: values observed quality valve to:

**TIGHTNESS CLASS: AH** 

With no packing adjusted≤SSA0> for re tightening

#### **ENDURANCE CLASS:**

CO2 1,500 cycles

#### **TEMPERAUTRE CLASS:**

Room temperature to 200℃

BUREAU VERITAS

REVIEWED
WITNESSED
DATE

SWI VALVE CO.LTD.

Performance class: ISO FE AH- CO2 - SSA0 - t- (200°C)-CL600- ISO 15848-1

| TEST CHECKED BY:                  | TEST APPROVED BY :                  |
|-----------------------------------|-------------------------------------|
| JONG WOO, SOHN                    | YONG PYO, CHO                       |
|                                   |                                     |
|                                   |                                     |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |

FORM-FET-01





### TEST/INSPECTION CERTIFICATE

DATE: 2010.06.26

SWI ORDER NO.: SO20100300254

1023-2, Kwanyang-Dong, Dongan-Gu, Anyang, Kyunggi-Do, Korea. TEL: 82-31-422-7495/7 FAX: 82-31-422-7498

CERTIFICATE NO.

: 1003254

PROJECT NAME / NO: Fugitive Emission Test sample

CUSTOMER/CLIENT :

SWI Valve co. Ltd.

PONO.:

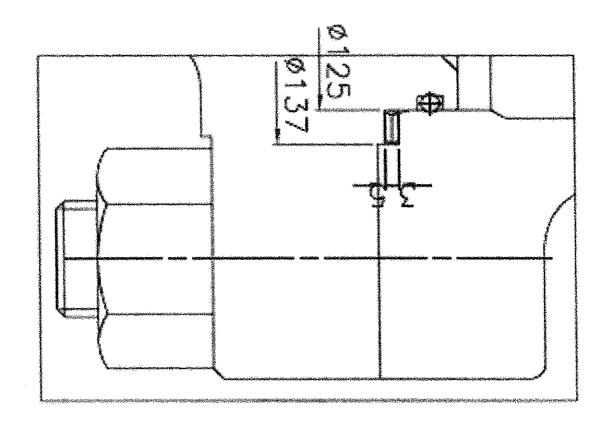
|     | ITEM DESCRIPTION              | ESCRIPTION Class Press (inch) | E Q'ty  | Hydrostatic Test<br>(kg/cm²) |      | Air Test<br>(kg/cm²)                     | Materials(ASTM)    |          |                  | Dimen<br>-sion      |                | Functi<br>-onal  |                |        |         |
|-----|-------------------------------|-------------------------------|---------|------------------------------|------|--|--------------------|----------|------------------|---------------------|----------------|--|----------------|--------|---------|
| NO. |                               | ITEM DESCRIPTION              | -ure    | (inch)                       | Q Ly | Shell                                    | Seat /<br>Backseat | Seat     | Body &<br>Bonnet | Seat Ring<br>(Seat) | Stem           | Wedge/ Disc<br>(Ball)  | Check          | -ction | Test    |
|     | 2-P TRUNNION BALL V/V RF      | 600#                          | 4"      | 1                            | 157  | N/A                                      | 7                  | A216-WCB | RTFE             | A276-316            | A276-316       | GOOD   | GOOD           | GOOD   | ACCEPTE |
|     |                               |                               |         |                              |      | 1, 10, 10, 10, 10, 10, 10, 10, 10, 10, 1 |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                |  |                |        |         |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                | 11.0   | REAL           | VERIT  | AS      |
|     |                               | ///                           |         |                              |      |  |                    |          |                  |                     |                |  | WITN<br>Box 16 | tssep. | 11/2    |
|     |                               |                               |         |                              |      |  |                    |          |                  |                     |                | and the same of th | PUAIS          |        | 35/     |
|     | 1. These standard for inspect | ion confo                     | a to AP | 508                          |      |  |                    |          |                  | Witn                | essed / Review | ed by C  | ustome         | r Rep. |         |

Q.A Manager

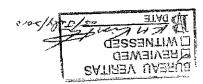
WE HEREBY CERTIFY THAT THE RESULTS MENTIONED ABOVE ARE TRUE AND CORRECT IN EVERY DETAIL

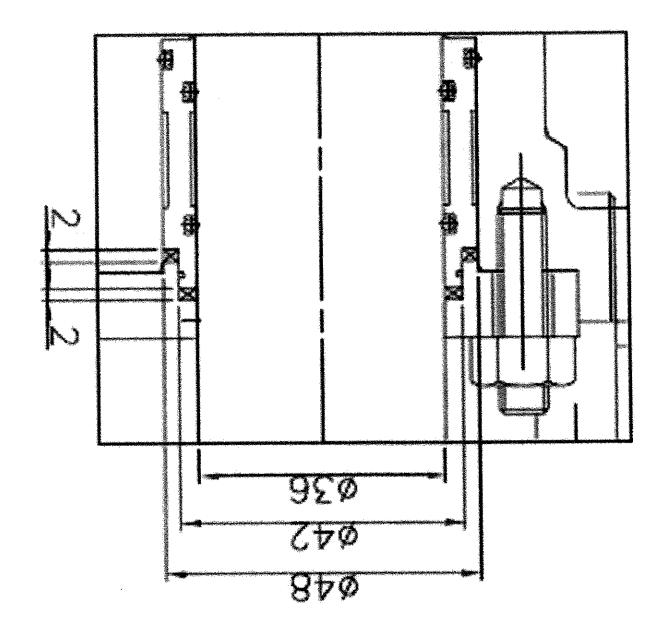
Y DEAR

**SWI-FORM QA-013** 



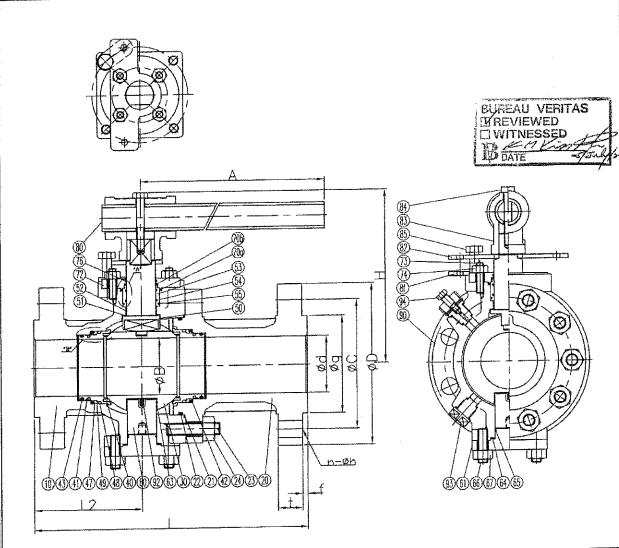
## Ball Valve Gasket Area





## Ball Valve Packing Area





| -           |     | ···· |     |     |     |     |     | <del></del> |       |       |       |       |       |        |       |     |    |
|-------------|-----|------|-----|-----|-----|-----|-----|-------------|-------|-------|-------|-------|-------|--------|-------|-----|----|
|             | i i |      | * 4 | 7.0 |     | 77  |     |             | End   | Conne | ction |       |       | WEIGHT |       | Tag | No |
| SIZE (Inch) | øΒ  | L    | L1  | L2  | A   | H.  | ød  | øD          | øg    | t     | f     | øС    | n-øh  | (kg)   | (pcs) |     |    |
| 2 X 2       | 49  | 292  |     | 120 | 450 | 195 | 49  | 165         | 92.1  | 25.4  | 7.0   | 127.0 | 8-ø19 | 23     | ,     |     |    |
| 3 X 3       | 74  | 356  | _   | 140 | 450 | 240 | 74  | 210         | 127.0 | 31.8  | 7.0   | 168.3 | 8-022 | 44     |       |     | ., |
| 4 X 4       | 100 | 432  |     | 180 | 600 | 285 | 100 | 275         | 157.2 |       | 7.0   | 215.9 | 8-ø26 | 72     |       |     |    |

| 22250 NO    |   |                 |          |                |                        |                      |          |           |     |              |
|-------------|---|-----------------|----------|----------------|------------------------|----------------------|----------|-----------|-----|--------------|
| ORDER NO. : |   |                 |          |                |                        |                      |          |           |     |              |
| <u>BIL</u>  | <u>L</u> OF   |                 | TER      | Д              |                        |                      | 47501    |           | _   | DENTAGE      |
| NO .        | DES<br>BODY   | <u>CRIPTI</u>   | ONS      | -              | A216                   | -VC9                 | ATER1    | AL        | _   | REMARK       |
| 20          | CAP   |                 |          |                | A216                   | -VC9                 |          |           |     |              |
| 21          | CAP GASKET  |                 |          |                | 3165                   | PV + GRA             | PHITE    |           |     | <del> </del> |
| 25<br>23    | CAP DERING  |                 |          |                | AL 2.                  | -97H                 |          |           |     |              |
| 24          | CAP BOLT  |                 |          |                | 8194                   | ~2HM<br>~CF8M        |          |           |     |              |
| 30<br>40    | SEAT  | ·····           |          |                | RIF                    | -                    |          |           |     |              |
| 4           | SEAT HOUR   | R               |          | _              | A27                    | 5-316/A3             | 1-CFBM   |           |     |              |
| 48<br>43    | SEAT SPRIN  | iG              |          |                | VIT                    | NEL X-75             | <u>u</u> |           |     |              |
| 47          | ENERGIZER<br>SEAT FIRE  |                 |          |                | A27                    | 5-316<br>HITE        |          |           |     |              |
| 48          | SPACER  | SAFE SE         | <u> </u> |                | PTF                    |                      |          |           |     |              |
| 50          | STEM  |                 | ,,       |                | A27                    | 5-316                |          |           |     |              |
| 52<br>52    | THRUST YA   | SHER<br>REARING |          |                | 3165                   | S + PIFE             |          |           |     |              |
| 53          | STEM BUSH<br>BUSH INNER   | ING             |          |                | AC.7                   | 6-316                |          |           |     |              |
| .54<br>55   | BUSH INNER  | O-RING          |          |                |                        | ON CAED)<br>ON CAED) |          |           |     |              |
| 60          | TRUNNION  |                 |          |                | A27                    | 6-316                |          |           |     |              |
| 61<br>63    | TOURSTON C  | DVER            | TNG.     |                | A105                   | S + PTFE             | ,        |           |     |              |
| 64          | COVER GAS   |                 |          | 316            | S + PTF                | APHITE               |          |           |     |              |
| 65          | COVER D-R   | ING             |          |                |                        | ON CAEDO<br>3-187M   |          |           |     |              |
| 66<br>67    | TRUMNION DRY BEARING COVER GASKET COVER D-RING COVER BOLT COVER NUT |                 |          |                | A19                    | HH3-1                |          |           |     |              |
| 70a         | I STEM COVER FIRE SAFE SE   |                 |          |                | GPA                    | PHITE                |          |           |     |              |
| 70a<br>72   | STEM FIRE SAFE SEAL<br>STEM COVER                                   |                 |          |                | Alos                   | i                    |          |           |     |              |
| 73          | STEM COVER BOLT<br>STEM COVER NUT                                   |                 |          |                | AL9                    | 9-117M<br>6-2HM      |          |           |     | -            |
| 74<br>76    | VIPER SEAL  |                 |          |                | NUD                    |                      |          |           |     |              |
| 80          | LEVER / 1   | -BAR TU         | BE       |                | A395 / A53<br>A240-316 |                      |          | LEVER DP. |     |              |
| 82<br>83    | STOPPER<br>T-BAR SOC  | KET             |          |                | A395                   |                      |          | LEVER OP. |     |              |
| 84          | T-BAR SOC<br>LEVER BOL<br>STOPPER B                                 | 1               |          |                |                        |                      |          | LEVER DP. |     |              |
| 95<br>8f    | LOCKING PI  | LATE            |          |                |                        | 0-315                |          |           |     | LEVER DP.    |
| 59          | NAMEPLATE   |                 |          |                | F A24                  | 0-3JA<br>ONEL X-7    | ra       |           |     |              |
| 93          | ANTI STAT   | C ZPRING        |          |                | 316                    | SS NATIONAL VAL      | 29       |           |     | 1            |
| 94          | BLEED VAL   | VE              |          |                | 316                    |                      |          |           |     |              |
| T           | **************************************                              | W T             | Shell    |                | :                      | 2225                 | Psi(     | 157       |     | Kgf/Cm²)     |
| Hydr        | raulic  | rest            | Back S   | eat            |                        | 1650                 | Psi(     | 117       | 7   | Kgf/Cm²)     |
| Pnet        | imatic  | Test            |          |                | :                      | 80                   | Psi(     | {         | }   | Kgf/Cm²)     |
| Seat        | Ring  |                 | Stelli   | te             | d (                    | #6)                  |          |           |     |              |
| Wedge       |   |                 | Stelli   | Stellited (#6) |                        |                      |          |           |     |              |
| Valve       | Valve Finishing   |                 |          | Phosphatized   |                        |                      |          |           |     |              |
| End         | Conne   |                 | Sock     | et             | W                      | eld (A               | NSI      | В         | 16  | 3.11)        |
| 1           |   |                 |          |                |                        |                      |          |           | ]   |              |
| Rev.        | No.   | [               | escrip)  | tic            | 'n                     |                      | RE       | A,D       | ) ] | APP'D        |
| TITLE       | C,  | AST             | STEEL    | _ 2            | 2-P                    | BAL                  | _VA      | LV        | Έ   |              |
|             | CI  | ASS             | 600 F    | Ę              | G'E                    | ) FU                 |          |           |     |              |
| Refer t     | o ASME  | B16.34          | Fig No.  |                |                        |                      |          |           |     | 112751-01    |
| Drown b     | y I.C.Jl  | JNG             | Chk'd by | 1              | (.H.                   | JUNG                 | App d    | by        | Н   | I.G.PARK     |

S W I Valve Co., Ltd.

CLIENT :



# TYPE APPOROVAL CERTIFICATE FOR GATE VALVE No. 940013/3-CT-06

| B.V. Job Ref: 3.30.1030.03  |  |   |
|---|--|---|
| Inspection ordered to B.V. by (1) : #102  |  | Ltd.<br>-dong,Dongan-gu, Anyang-si, Gyeonggi-do, Korea                                |
| Manufacturer: SWI Valve Co. Ltd., (1) the addressee of the original of this certificate:  | Korea  |   |
| Description of the Supply / Subjec  | t of inspection  | :   |
| Product: Forged Steel Gate Valve<br>Size of Tested Valve: 1"<br>Material of Tested Valve: ASTM A105t<br>Class of Tested Valve: #800<br>Stem Diameter: 11.1 mm<br>Tightness class: below 100ppm<br>Endurance class: 1500cycles<br>Temperature range: Room temperatur<br>Packing Adjustment number: 0   | N  |   |
| This certificate covers the whole of the supply:  | YES (no more inspec  | ction planned)  NO (part of the supply still to be inspected)                         |
| Scope of the B.V. Survey :  |  |   |
| - Witness for Type Test of Fugitive Emi   | ission Test  |   |
| This supply complies with the following and only for parts of the document(s) which conclist of enclosures: Test Report for Full (or reference to enclosed list)  The certificate is valid together with enclosures (if listed).  | ve Packing for Fu<br>cern the certification or<br>ugitive Emission T | gitive Emissions<br>the relevant service provided by Bureau Veritas.                  |
| Marking and Stamping on the item  | ıs: None   |   |
| Particulars or comments: This is to certify that the following valves The Fugitive Emission Test in accordance  | s have been inspe<br>ce with API 622 F                               | ected by Bureau Veritas and found to be satisfactory in<br>irst Edition, August 2006. |
| Date of Issuance: 07-July-2010<br>Date of Inspection: 14 to 16-Jun-2010   | Issued by :<br>Name : K. M. Ki                                       |   |
| Location of Inspection : BV-Korea, Secu-<br>This certificate is deliverence within the Scope of the General Colix<br>Ce Certificat est déliviré dans le cadre des Conditions Générales de   | ditions of Services of Bureau '                                      | verilas SEQUE   |
| This certificate is issued further to an inspection whose were limited by the terms and conditions of the contract. This certificate is NOT an indication that the item(s) is (a specific purpose and does not release the manufacturer party from their respective duty, guarantee obligation at relating to, without limitation, patents, workmanship, maperformance in operation and/or reliability. | with BV principal. are) fit for any supplier and any nd/or indemnity |   |

Ad ME 9613b



REPORT.NO. SWI-FET-06

LSSUED DATE 05.JULY.2010

CHECKED BY JONGWOO,SOHN

APPROVED BY YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

Page 1 of 3

## PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 14<sup>th</sup> June,2010 to 16<sup>th</sup> June,2010

### 1 VALVE SPECIFICATION

| Valve size & type  | GATE Valve A105N/13CRFS SW 800#  |  |  |
|--------------------|--|--|--|
|                    | BB RB 1"   |  |  |
| Material of Valve  | A105N  |  |  |
| Valve class        | 800#   |  |  |
| Stem diameter      | 11.1 mm  |  |  |
| Gland packing type | Graphile Braided Packing+Graphile Molded Packing  Model No.: DAEWHA 6511+ 9001 |  |  |
| Packing material   | Graphite , Graphite + Inconel Wire   |  |  |
| Operating torque   | 30 ft-lbs  |  |  |
| Stroke             | 24.3 mm  |  |  |
|                    |  |  |  |

### 2TEST CONDITION

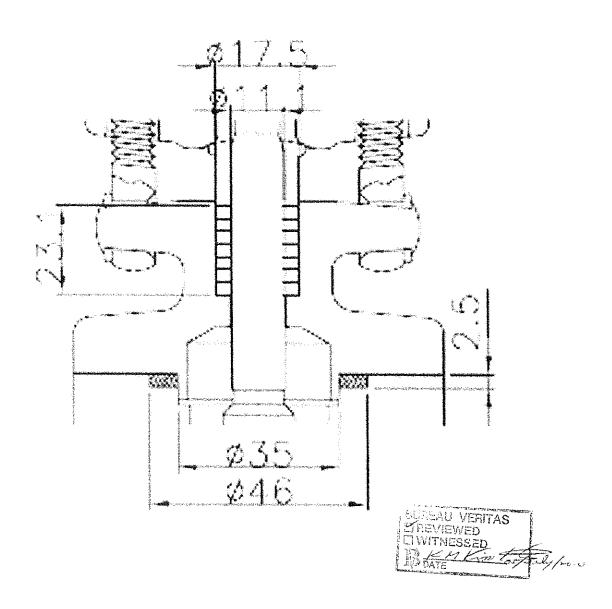
| Test pressure                 | 136-110bar                                    |  |  |  |
|-------------------------------|---|--|--|--|
| Test medium                   | He 99%  |  |  |  |
| Check medium                  | He 99%  | - A lower state like of market 111 and |  |  |
| Test temperature              | RT/ 260°C                                     |  |  |  |
| Test equipment                | Fugitive emission test equip, manufactured by |  |  |  |
|                               | SWI VALVE CO. LTD.                            |  |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |  |  |  |
| Sampling method               | Random  |  |  |  |
| Valve repacking before test   | 0   | OUREAU VERITAS   |  |  |
| Insulation of test valve      | Heating Jacket used                           | I WITNESSED  |  |  |
| Actuator                      | Geared motor                                  | DATE   |  |  |

| API Std 622                      |                       |                              |                       |  |   |                |
|----------------------------------|-----------------------|------------------------------|-----------------------|--|---|----------------|
|                                  | Fugitive Emis         | sions Testing Report         | Number: SWI- FET-     | 06   |   |                |
| Application Profile : C          | Check One<br>☑ Rising | ALLE INVE                    |                       | Manufacturer: SW<br>Description: Gate  |   |                |
| Testing Facility: SWI            | Factory               |                              |                       | -  |   |                |
| Technician: JongWoo              |                       |                              |                       |  | ufacturer Date: 10 <sup>th</sup> June,2   | 2010           |
| Witness: Ki-Man , Kir            | n.                    |                              |                       | ☐ Dis  | tributor                                  |                |
| Start date: 14 <sup>TH</sup> Jun | e,2010                | Completion: 16 <sup>TH</sup> | June,2010             | Packaged:  | , many                                    |                |
| Gland Load<br>Information psi.   | G                     | land Nut Torque :29          | ft-lbs                | Indicate New or<br>Current Product   | <ul><li>○ New</li><li>☑ Current</li></ul> |                |
| Notes concerning ins             | tallation instruction | 18                           |                       | de la companya de la |   |                |
|                                  |                       | Te                           | sting Profile Details |  |   |                |
|                                  | Leak                  |                              | Reference             | Flats Adjusted-  |   |                |
| Tt C                             | measurement           | 7                            | Temperature(°C)       | Gland Nut  | Reference A                               |                |
| Test Segment                     | (ppm)                 | Temperature(℃)               | at packing gland      | Torque ft-lbs  | Height (mm)                               |                |
| Day1                             | 0                     | Room temp.                   | Room temp.            | 29   | 44,49                                     |                |
| ,                                | 0                     | Room temp.                   | Room temp.            |  |   |                |
| Start,Ambient                    | 0                     | Room temp.                   | Room temp.            |  |   |                |
| 0-250 cycles                     | 4                     | Room temp.                   | Room temp.            |  |   |                |
| P=136(bar)                       | 4                     | Room temp.                   | Room temp.            |  |   |                |
| (22.)                            | 2                     | Room temp.                   | Room temp.            |  |   |                |
| High Temperature                 | 25                    | 260°C                        | 220°C                 |  |   |                |
|                                  | 29                    | 260 ℃                        | 220°C                 |  |   |                |
| 250-500cycles                    | 36                    | 260°C                        | 220°C                 |  |   |                |
| P=110(bar)                       | 37                    | 260℃                         | 220°C                 |  |   |                |
|                                  |                       |                              | 1                     |  |   |                |
|                                  | 38                    | 260°C                        | 220°C                 |  |   |                |
| Day2                             | 12                    | Room temp.                   | Room temp.            |  |   |                |
| Charl Arching                    | 26                    | Room temp.                   | Room temp.            |  |   |                |
| Start,Ambient                    | 29                    | Room temp.                   | Room temp.            | 1  |   |                |
| 500-750 cycles                   | 34                    | Room temp.                   | Room temp.            |  |   |                |
| P=136(bar)                       | 39                    | Room temp.                   | Room temp.            |  |   |                |
|                                  | 42                    | Room temp.                   | Room temp.            |  |   |                |
| High Temperature                 | 53                    | 260 °C                       | 220°C                 |  |   |                |
| •                                | 56                    | 260°C                        | 220°C                 |  |   |                |
| 750-1000 cycles                  | 58                    | 260°C                        | 220°C                 |  |   |                |
| P=110(bar)                       | 62                    | 260 °C                       | 220°C                 |  |   |                |
|                                  |                       |                              |                       |  |   |                |
|                                  | 65                    | 260°C                        | 220°C                 | 1  |   |                |
| Day3                             | 46                    | Room temp.                   | Room temp.            |  |   | · ·            |
| Start, Ambient                   | 43                    | Room temp.                   | Room temp.            |  |   |                |
| •                                | 49                    | Room temp.                   | Room temp.            |  |   | ,              |
| 1000-1250 cycles                 | 61                    | Room temp.                   | Room temp.            |  |   |                |
| P=136(bar)                       | 69                    | Room temp.                   | Room temp.            |  |   |                |
|                                  | 70                    | Room temp.                   | Room temp.            |  | WUREAU VERITA                             | \ <del>S</del> |
| High Temperature                 | 73                    | 260℃                         | 220°C                 |  | 国REVIEWED                                 |                |
| 1250-1500cycles                  | 79                    | 260 °C                       | 220°C                 |  | WITNESSED                                 | 11             |
| ,                                | 83                    | 260 C                        | 220℃                  |  | D DATE                                    | 00/1001        |
| P=110(bar)                       | 89                    | 260℃                         | 220°C                 |  |   |                |
| ı                                | 92                    | 260°C                        | 220℃                  |  |   |                |
| A graph denicting th             |                       |                              |                       | shall be provide by  | the testing authority.                    |                |

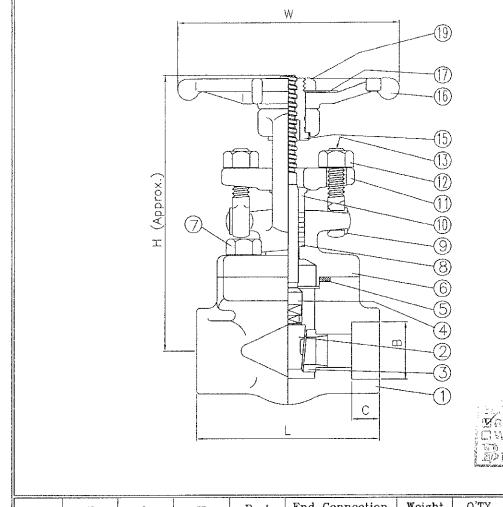
| API Std 622  |   |
|--|---|
| Emissions Tes  | ting Report Summary   |
| Test Number; SWI-FET-06                                      | Test Date: 14 <sup>th</sup> to 16 <sup>th</sup> June , 2010 |
| Packing Material: Graphite, Graphite+ inconel wire           | Style Number:   |
| Packing Manufacturer: DAEWHA 6511+ 9001                      | Source of Sample: GATE A105N/13CRFS SW 800# BB RB 1"        |
| Test Packing Cross-section: Rectangle                        | Laboratory Name: SWI LABORATORY                             |
|  | Location of Test: SWI FACTORY                               |
| Packing Gland OD and ID(at the packing):                     | Packing Gland Bolt Diameter= 7.9 mm                         |
| OD= 17.6 ID= 11.1  |   |
| Number of Mechanical Cycles: 750                             | Packing Compression % of Free Height= 80%                   |
|  | Torque on Gland Nuts(each side)=29/29 (ft-lbs)              |
| Number of Thermal Cycles: 750                                | Mechanical Cycles Prior to Readjustment:                    |
|  | Non-applicable .  |
| Maximum Test Pressure: 136 bar                               | Number of Readjustments: 0                                  |
| Packing Configuration: Graphite + Graphite with inconel wire | Show Sketch of Packing Installation-define each ring:       |
| Number of rings tested: 7                                    |   |
| Circle the following   |   |
| Ring shape (square, circular, vee)                           |   |
| Solid or split   |   |
| Braided  |   |
| Die formed   | 自自用   |
| Spool stock  |   |
| Wire or other reinforcement                                  |   |
| Corrosion inhibitor &type                                    |   |
| Other  |   |



| TEST CHECKED BY:                  | TEST APPROVED BY :                  |  |  |
|-----------------------------------|-------------------------------------|--|--|
| JONG WOO, SOHN                    | YONG PYO, CHO                       |  |  |
|                                   | y n che                             |  |  |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |  |  |



Gale



| OF  | RDER NO.         | -                       |                         |
|-----|------------------|-------------------------|-------------------------|
| В   | ILL OF           | MATERIALS               | 3                       |
| NO. | PARTS            | MATERIALS               | ASTM                    |
| 1   | Body             | Forged Steel            | A105N                   |
| 2   | Wedge            | Stainless Steel         | A351~CF8M               |
| 3   | Seat Ring        | Stainless Steel         | A276-316                |
| 4   | Stem             | Stainless Steel         | A276-316                |
| 5   | Gasket           | 316 Hoop + Graphite     |                         |
| 6   | Bonnet           | Forged Steel            | A105N                   |
| 7   | Bonnet Bolt      | Alloy Steel             | A193-B7                 |
| 8   | Gland Packing    | Graphite + Carbon Fiber |                         |
| 9   | Retaining Washer | Stainless Steel         | A276-304                |
| 10  | Gland            | Stainless Steel         | A276-316                |
| 11  | Gland Flange     | Forged Steel            | A105                    |
| 12  | Gland Nut        | Carbon Steel            | A194-2H                 |
| 13  | Eye Bolt         | Stainless Steel         | A276-304                |
| 15  | Yoke Sleeve      | 13Cr Stainless Steel    | A276-410                |
| 16  | Handwheel        | Malleable Iron          | A47                     |
| 17  | Name Plate       | Aluminum                |                         |
| 19  | Handwheel Nut    | Carbon Steel            | A563A                   |
| -   |                  |                         |                         |
|     |                  |                         |                         |
|     |                  | Shell : 2975 Psi        | 210 Kg//Cm <sup>2</sup> |

| Hardwardia Toot                       | Shell : 2975 Psi( 210 Kg/Cm <sup>2</sup> )     |
|---------------------------------------|--|
| Hydraulic Test                        | Back Seat : 2175 Psi( 153 Kg/Cm <sup>2</sup> ) |
| Pneumatic Test                        | Seat : 80 Psi( 6 Kgf/Cm²)                      |
| Seat Ring                             | Stellited (#6)                                 |
| Wedge                                 | Stellited (#6)                                 |
| Valve Finishing                       | Phosphatized                                   |
| End Connection                        | Socket Weld (ANSI B 16.11)                     |
| · · · · · · · · · · · · · · · · · · · |  |

| 1 |          |             |       |       |  |  |
|---|----------|-------------|-------|-------|--|--|
| 1 | 3        |             |       |       |  |  |
| 4 | 2        |             |       |       |  |  |
|   | 1        |             |       |       |  |  |
|   | Rev. No. | Description | REV'D | APP'D |  |  |
|   | F        |             |       |       |  |  |

TITLE FORGED STEEL GATE VALVE CLASS 800 BB OS & Y S.W REDUCED PORT

| L |          |         |        |          |             |       |             |
|---|----------|---------|--------|----------|-------------|-------|-------------|
|   | Refer to | API 6   | O2 Fig | No.      | D.W.        | 3. No | 09020651-01 |
| Į | Drawn by | I.C.JUN | 4G Chk | d by J.E | B.CHOI App' | d by  | K.H.JUNG    |

CLIENT :

S W I Valve Co., Ltd.

| SIZE   | н      | L   | w   | Port | End Con | nection | Weight | Q'TY  | Valve No. |
|--------|--------|-----|-----|------|---------|---------|--------|-------|-----------|
| (Inch) | (Open) | ••  |     | Dia. | В       | С       | (Kg)   | (pcs) |           |
| 1/2    | 145    | 76  | 102 | 9.5  | 21.8    | 10      | 1.5    |       |           |
| 3/4    | 151    | 86  | 102 | 12.7 | 27.2    | 13      | 2.0    |       |           |
| 1      | 190    | 102 | 114 | 18.0 | 33.9    | 13      | 2.8    |       |           |
| 1-1/4  | 241    | 117 | 140 | 31.0 | 42.7    | 13      | 5.2    |       |           |
| 1-1/2  | 241    | 117 | 140 | 31.0 | 48.8    | 13      | 5,1    |       |           |
| 2      | 271    | 133 | 165 | 37.0 | 61.2    | 16      | 8.2    |       |           |



## TYPE APPOROVAL CERTIFICATE FOR GLOBE VALVE No. 940013/3-CT-07

B.V. Job Ref: 3.30.1030.03

Inspection ordered to B.V. by (1): SWI Valve Co. Ltd.

#1023-2 Gwanyang 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea

Manufacturer: SWI Valve Co. Ltd., Korea (1) the addressee of the original of this certificate;

### Description of the Supply / Subject of inspection:

Product: Forged Steel Globe Valve Material of Tested Valve : ASTM A105N

Size of Tested Valve: 1' Class of Tested Valve: #800 Stem Diameter: 12.7 mm Tightness class: below 100ppm Endurance class: 1500cycles

Temperature range : Room temperature to +260 ℃

Packing adjustment number: 0

This certificate covers the whole of the supply: 🗵 YES (no more inspection planned) 🔲 NO (part of the supply still to be inspected)

#### Scope of the B.V. Survey:

- Witness for Type Test of Fugitive Emission Test

### This supply complies with the following applicable document (s): (2)

- API 622 Type Testing of Process Valve Packing for Fugitive Emissions
(2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas.

List of enclosures: Test Report for Fugitive Emission Test ---- 5 Pages

(or reference to enclosed list)
The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate.

### Marking and Stamping on the items: None

#### Particulars or comments:

This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactory in The Fugitive Emission Test in accordance with API 622 First Edition, August 2006.

Date of Issuance: 07-July-2010

Issued by:

Validated by:

Date of Inspection: 17 to 19-Jun-2010

Name: K. M. Kim

Name: Y. M. Moon

·MM

Sign:

Location of Inspection: BV-Korea, Seoul Office

This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Vertias. Ce Certificat est délivré dans le cadre des Conditions Genérales de Service du Bureau Vertias.

This certificate is issued further to an inspection whose duration and scope were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any

specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity relating to, without limitation, patents, workmanship, materials, safety, performance in operation and/or reliability.

Ad ME 9613b



REPORT.NO. SWI-FET-07

ISSUED DATE 05.JULY.2010

CHECKED BY JONGWOO,SOHN

APPROVED BY YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

Page 1 of 3

## PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 17<sup>th</sup> June,2010 to 19<sup>th</sup> June,2010

### 1 VALVE SPECIFICATION

| Valve size & type  | GLOBE Valve A105N/13CRFS SW 800#                 |
|--------------------|--|
|                    | BB RB 1"   |
| Material of Valve  | A105N  |
| Valve class        | 800#   |
| Stem diameter      | 12.7 mm  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |
|                    | Model No. : DAEWHA 6511+ 9001                    |
| Packing material   | Graphite , Graphite + Inconel Wire               |
| Operating torque   | 30 ft-lbs  |
| Stroke / Angle     | 7.8 mm   |

#### 2TEST CONDITION

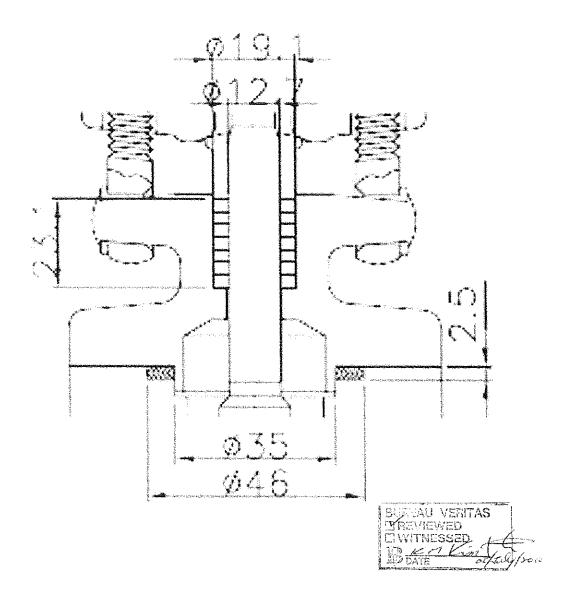
| Test pressure                 | 136-110bar                                   | A STATE OF THE STA |  |  |
|-------------------------------|--|--|--|--|
| Test medium                   | He 99%                                       |  |  |  |
| Check medium                  | He 99%                                       |  |  |  |
| Test temperature              | RT/ 260°C                                    |  |  |  |
| Test equipment                | Fugitive emission test equip, manufactured l |  |  |  |
|                               | SWI VALVE CO. LTD.                           |  |  |  |
| Leakage measurement equipment | Helium Detector(ALCATE                       | L Model ASM142 series)   |  |  |
| Sampling method               | Random                                       | The second secon |  |  |
| Valve repacking before test   | 0  | BUREAU VERITAS   |  |  |
| Insulation of test valve      | Heating Jacket used                          | WITNESSED TO ACCOUNT   |  |  |
| Actuator                      | Geared motor                                 | LAP DATE   |  |  |

| API Std 622                           | Fuaitive Emis          | sions Testing Report           | Number SWLFFT-0                  | 07                           |                                       |                           |
|---------------------------------------|------------------------|--------------------------------|----------------------------------|------------------------------|---------------------------------------|---------------------------|
| Application Profile : 0               |                        | Sierio resung Report           | Hamber, Over L. P.               | ·                            | /I VALVE CO. LTD.                     |                           |
|                                       | Rising                 |                                |                                  |                              | n VALVE CO, LTD.<br>e A105 800# SW 1' |                           |
| Testing Facility: SWI                 |                        |                                |                                  |                              |                                       |                           |
| Technician: JongWoo                   | o, Sohn                |                                |                                  | 1                            | nufacturer Date: 1                    | 0 <sup>th</sup> June,2010 |
| Witness: Ki-Man , Kir                 |                        |                                |                                  | ∐ Dis                        | tributor                              |                           |
| Start date: 17 <sup>TH</sup> Jur      | ne,2010                | Completion. 19 <sup>TH</sup> . | June,2010                        | Packaged:<br>Indicate New or | □ New                                 |                           |
| Gland Load                            | ,                      | Gland Nut Torque : 2           | 8 ft-lbs                         | Current Product              | □ New     □ Current     □             |                           |
| Information psi. Notes concerning ins | stallation instruction | ng .                           |                                  |                              |                                       |                           |
|                                       | nandron (notraction    |                                |                                  |                              |                                       |                           |
|                                       |                        | Te                             | sting Profile Details            | 4                            |                                       |                           |
|                                       | Leak                   |                                | Reference                        | Flats Adjusted-              | D-f 4                                 |                           |
| Test Segment                          | measurement<br>(ppm)   | Temperature(°C)                | Temperature(°C) at packing gland | Gland Nut<br>Torque ft-lbs   | Reference A<br>Height (mm)            |                           |
| Day1                                  | 0                      | Room temp.                     | Room temp.                       | 28                           | 44.5                                  |                           |
| *                                     | 0                      | Room temp.                     | Room temp.                       |                              |                                       |                           |
| Start,Ambient                         | 0                      | Room temp.                     | Room temp.                       |                              |                                       |                           |
| 0-250 cycles                          | 4                      | Room temp.                     | Room temp.                       |                              |                                       |                           |
| P=136(bar)                            | 4                      | Room temp.                     | Room temp.                       |                              |                                       |                           |
|                                       | 6                      | Room temp.                     | Room temp.                       |                              |                                       |                           |
| High Temperature                      | 22                     | 260°C                          | 220°C                            |                              |                                       |                           |
| 250-500cycles                         | 27                     | 260℃                           | 220℃                             |                              |                                       |                           |
| ·                                     | 35                     | 260℃                           | 220°C                            |                              |                                       |                           |
| P=110(bar)                            | 36                     | 260°C                          | 220 0                            |                              |                                       |                           |
|                                       | 38                     | 260℃                           | 220℃                             |                              |                                       |                           |
| Day2                                  | 10                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| Odyz                                  | 22                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| Start,Ambient                         | 24                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| 500-750 cycles                        | 31                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| P=136(bar)                            | 36                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
|                                       | 41                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| High Temperature                      | 49                     | 260℃                           | 220°C                            |                              |                                       | :                         |
| 750-1000 cycles                       | 52                     | 260 C                          | 220℃                             |                              |                                       |                           |
| ·                                     | 52                     | 260 C                          | 220 ℃                            |                              |                                       |                           |
| P=110(bar)                            | 57                     | 260°C                          | 220°C                            |                              |                                       |                           |
|                                       | 59                     | 260℃                           | 220℃                             |                              |                                       |                           |
| D. 0                                  | 43                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| Day3                                  | 45                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| Start.Ambient                         | 46                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| 1000-1250 cycles                      | 55                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| P=136(bar)                            | 57                     | Room temp.                     | Room temp.                       |                              |                                       |                           |
| ,                                     | 62                     | Room temp.                     | Room temp,                       |                              |                                       |                           |
| High Temperature                      | 68                     | 260°C                          | 220℃                             | -                            | BUREAU VERI                           | TAS I                     |
| 1250-1500cycles                       | 72                     | 260℃                           | 220℃                             | 1                            | TREVIEWED                             |                           |
| •                                     | 78                     | 260℃                           | 220℃                             |                              | WITNESSED                             | IF                        |
| P=110(bar)                            | 79                     | 260°C                          | 220°C                            |                              | A DATE                                | 30/Jaly/sa.               |
|                                       | 85                     | 260℃                           | 220℃                             | -                            |                                       | The state of              |
| A graph depicting th                  |                        | associated leak chec           |                                  | shall be provide by          | the testing authori                   | tv.                       |

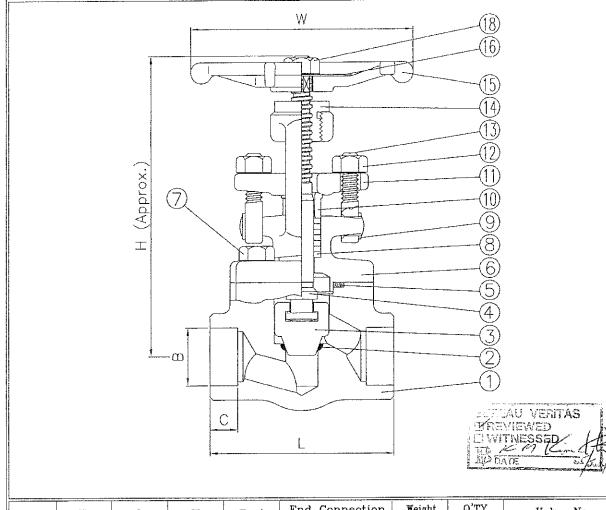
| API Std 622  |   |  |  |  |
|--|---|--|--|--|
| Emissions Tes  | ting Report Summary                                   |  |  |  |
| Test Number: SWI-FET-07                                      | Test Date: 17 <sup>th</sup> to19th June 2010          |  |  |  |
| Packing Material: Graphite, Graphite+ inconel wire           | Style Number:   |  |  |  |
| Packing Manufacturer: DAEWHA 6511+ 9001                      | Source of Sample: GLOBE A105N/13CRFS SW BB RB 800# 1" |  |  |  |
| Test Packing Cross-section: Rectangle                        | Laboratory Name: SWI LABORATORY                       |  |  |  |
|  | Location of Test: SWI FACTORY                         |  |  |  |
| Packing Gland OD and ID(at the packing):                     | Packing Gland Bolt Diameter= 7.9 mm                   |  |  |  |
| OD= 19.1 ID= 12.7  |   |  |  |  |
| Number of Mechanical Cycles: 750                             | Packing Compression % of Free Height= 80%             |  |  |  |
|  | Torque on Gland Nuts(each side)= 28/28 (ft-lbs)       |  |  |  |
| Number of Thermal Cycles: 750                                | Mechanical Cycles Prior to Readjustment:              |  |  |  |
|  | Non-applicable .                                      |  |  |  |
| Maximum Test Pressure: 136 bar                               | Number of Readjustments: 0                            |  |  |  |
| Packing Configuration: Graphite + Graphite with inconel wire | Show Sketch of Packing Installation-define each ring: |  |  |  |
| Number of rings tested: 7                                    | <del>  -</del> 4                                      |  |  |  |
| Circle the following   |   |  |  |  |
| Ring shape (square, circular, vee)                           |   |  |  |  |
| Solid or split   |   |  |  |  |
| Braided  |   |  |  |  |
| Die formed   | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                 |  |  |  |
| Spool stock  |   |  |  |  |
|  |   |  |  |  |
| Wire or other reinforcement                                  |   |  |  |  |
| Corrosion inhibitor &type                                    |   |  |  |  |
| Others   |   |  |  |  |
| Other  |   |  |  |  |



| TEST CHECKED BY:                  | TEST APPROVED BY :                  |
|-----------------------------------|-------------------------------------|
| JONG WOO , SOHN                   | YONG PYO, CHO                       |
| 1/3                               | y P cho                             |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |



Globe



| SIZE   | н      | L   | w   | Port | End Cor | nection | Weight | Q'TY  | Valve No. |
|--------|--------|-----|-----|------|---------|---------|--------|-------|-----------|
| (Inch) | (Open) | -   |     | Dia. | В       | C       | (Kg)   | (pcs) |           |
| 1/2    | 146    | 76  | 102 | 9.5  | 21.8    | 10      | 1.8    |       |           |
| 3/4    | 152    | 86  | 102 | 12.7 | 27.2    | 13      | 2.1    |       |           |
| 1      | 188    | 102 | 114 | 17.5 | 33.9    | 13      | 2.9    |       |           |
| 1-1/4  | 219    | 152 | 140 | 22.5 | 42.7    | 13      | 6.4    |       |           |
| 1-1/2  | 219    | 152 | 140 | 29.5 | 48.8    | 13      | 6.2    |       |           |
| 2      | 260    | 172 | 165 | 35.0 | 61.2    | 16      | 9.7    |       |           |

| CAPACITY CONTRACTOR CO |                         |                             |
|--|-------------------------|-----------------------------|
| ORDER NO. :  |                         |                             |
| BILL OF  | MATERIALS               | )                           |
| NO. PARTS  | MATERIALS               | ASTM                        |
| 1 Body   | Forged Steel            | A105N                       |
| 2 Seat   | Stellite Hardfacing     |                             |
| 3 Disc   | 13Cr Stainless Steel    | A217-CA15                   |
| 4 Stem   | 13Cr Stainless Steel    | A276-410                    |
| 5 Gasket   | 304 Hoop + Graphite     |                             |
| 6 Bonnet   | Forged Steel            | A105N                       |
| 7 Bonnet Bolt  | Alloy steel             | A193-B7                     |
| 8 Gland Packing  | Graphite + Carbon Fiber |                             |
| 9 Ret. Washer  | Stainless Steel         | A276-304                    |
| 10 Gland   | Stainless Steel         | A276-316                    |
| 11 Gland Flange  | Forged Steel            | A105                        |
| 12 Gland Nut   | Carbon Steel            | A1942H                      |
| 13 Eye Bolt  | Stainless Steel         | A276-304                    |
| 14 Yoke Bush   | 13Cr Stainless Steel    | A276-410                    |
| 15 Handwheel   | Malleable Iron          | A47                         |
| 16 Name Plate  | Aluminum                |                             |
| 18 Handwheel Nut   | Carbon Steel            | A194-2H                     |
|  |                         |                             |
|  |                         |                             |
|  |                         |                             |
|  |                         |                             |
|  | j                       |                             |
|  | Shell : 2975 Psi        |                             |
| Hydraulic Test   | Back Seat: 2175 Psi     | ( 153 Kg//Cm <sup>2</sup> ) |
| 1,   | Seat : 2175 Psi         | 153 Kg//Cm <sup>2</sup> )   |
| Seat of Body   | Hardfaced with Stellite | #6 on Body                  |
| Disc   | Stellited (#6)          | и                           |
| Valve Finishing  | Phosphatized            |                             |
| End Connection   | Socket Weld (ANSI       | B 16.11)                    |
| 3  |                         |                             |
| <u> </u>   |                         |                             |

| TITLE | FOI | RGEI | ) S | TEI | Ľ  | GI | OBE. | VALVE | CLASS | 800 |
|-------|-----|------|-----|-----|----|----|------|-------|-------|-----|
|       | BB  | 08   | &   | Y   | S. | W  | REI  | OUCED | PORT  |     |

REV'D APP'D

Description

| Refer to | AP1602 / BS5352 | Fig No.  |          | D.W.G. No. | 10032651-01 |
|----------|-----------------|----------|----------|------------|-------------|
| Drawn by | I.C.JUNG        | Chk'd by | J.B.CHOI | App'd by   | K,H.JUNG    |

CLIENT :

Rev. No.

S W I Valve Co., Ltd.



## TYPE APPOROVAL CERTIFICATE FOR GATE BELLOWS VALVE No. 940013/3-CT-08

B.V. Job Ref: 3,30,1030.03 Inspection ordered to B.V. by (1): SWI Valve Co. Ltd. #1023-2 Gwanyang 1-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea Manufacturer: SWI Valve Co. Ltd., Korea (1) the addressee of the original of this certificate Description of the Supply / Subject of inspection: Product: Forged Steel Gate Bellows Valve Size of Tested Valve: 1" Material of Tested Valve: ASTM A105N Class of Tested Valve: #800 Stem Diameter: 11.1 mm Tightness class: below 100ppm Endurance class: 1500cycles Temperature range: Room temperature to +260 ℃ Packing adjustment number: 0 This certificate covers the whole of the supply: 🔯 YES (no more inspection planned) 🗀 NO (part of the supply still to be inspected) Scope of the B.V. Survey: - Witness for Type Test of Fugitive Emission Test This supply complies with the following applicable document (s): (2) - API 622 Type Testing of Process Valve Packing for Fugitive Emissions (2) and only for parts of the document(s) which concern the certification or the relevant service provided by Bureau Veritas. List of enclosures: Test Report for Fugitive Emission Test ----- 5 Pages (or reference to enclosed list) The certificate is valid together with enclosures (if listed). Only pages of enclosures (or parts of pages) which are stamped, are considered as part of this certificate Marking and Stamping on the items: None Particulars or comments: This is to certify that the following valves have been inspected by Bureau Veritas and found to be satisfactory in The Fugitive Emission Test in accordance with API 622 First Edition, August 2006. Date of Issuance: 07-July-2010 Issued by: Validated by: Date of Inspection: 21 to 23-Jun-2010 Name: K. M. Kim Name: Y. M. Moon Marin Sign: Location of Inspection: BV-Korea, Seoul Office This certificate is deliverered within the Scope of the General Conditions of Services of Bureau Ventas Ce Certificat est déliviré dans la cadre des Conditions Générales de Service du Bureau Ventas This certificate is issued further to an inspection whose duration and scope SEOUL were limited by the terms and conditions of the contract with BV principal. This certificate is NOT an indication that the item(s) is (are) fit for any specific purpose and does not release the manufacturer, supplier and any party from their respective duty, guarantee, obligation and/or indemnity

13

Ad ME 9613b

relating to, without limitation, patents, workmanship, materials, safety,

performance in operation and/or reliability.



| REPORT.No.  | SWI-FET-08   |
|-------------|--------------|
| ISSUED DATE | 05.July.2010 |
| CHECKED BY  | JongWoo,Sohn |
| Approved By | Yongpyo,Cho  |

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

Page 1 of 3

## PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 21<sup>st</sup> June,2010 to 23<sup>rd</sup> June,2010

### 1 VALVE SPECIFICATION

| Valve size & type  | GATE Bellows Valve A105N/13CRFS SW               |
|--------------------|--|
|                    | 800# WB RB 1"                                    |
| Material of Valve  | A105N  |
| Valve class        | 800#   |
| Stem diameter      | 11.1 mm  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |
|                    | Model No. : DAEWHA 6511+ 9001                    |
| Packing material   | Graphite , Graphite + Inconel Wire               |
| Operating torque   | 21 ft-lbs  |
| Stroke / Angle     | 24.3mm   |

### 2TEST CONDITION

| Test pressure                 | 136-110bar                                    |      |  |  |  |
|-------------------------------|---|------|--|--|--|
| Test medium                   | He 99%  |      |  |  |  |
| Check medium                  | He 99%  |      |  |  |  |
| Test temperature              | RT/ 260℃                                      |      |  |  |  |
| Test equipment                | rnt Fugitive emission test equip, manufacture |      |  |  |  |
|                               | SWI VALVE CO. LTD.                            |      |  |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |      |  |  |  |
| Sampling method               | Random  |      |  |  |  |
| Valve repacking before test   | 0 BUREAU VER                                  |      |  |  |  |
| Insulation of test valve      | Heating Jacket used <b>図WITNESS</b>           |      |  |  |  |
| Actuator                      | Geared motor                                  | DATE |  |  |  |

FORM-FET-01

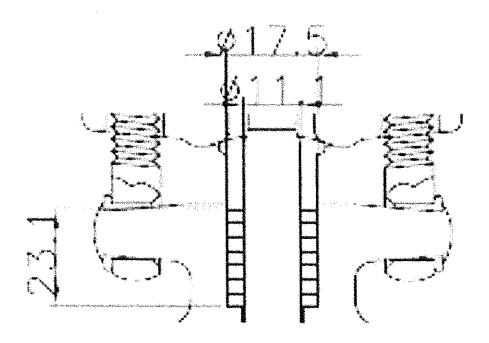
SWI VALVE CO.LTD.

|   |                        | ssions Testing Report          | I Number: SVVI-FE1-0  | ,                                  |   |         |
|---|------------------------|--------------------------------|-----------------------|------------------------------------|---|---------|
| Application Profile : (                                   |                        |                                |                       | Manufacturer: SW                   | VALVE CO. LTD.                          |         |
|   | Rising                 |                                |                       | Description: Gate                  | bellows A105 800# SW 1                  | »       |
| Testing Facility: SWI                                     | ,                      |                                |                       | <br>  Source: ☑ Man                | ufacturer Date: 10 <sup>th</sup> Jur    | a 2010  |
| Technician: JongWoo                                       |                        |                                |                       | 1                                  | tributor                                | 16,2010 |
| Witness: Ki-Man , Ki<br>Start date: 21 <sup>st</sup> June |                        | Completion: 23 <sup>RD</sup> J | 2040                  |                                    |   |         |
| Start Gate. 21 Julie                                      | ,2010                  | Completion: 23 J               | une,2010              | Packaged:                          | =: 14                                   |         |
| Gland Load  |                        | Gland Nut Torque:              | 25 ft-lbs             | Indicate New or<br>Current Product | New ✓ Current                           |         |
| nformation psi.   |                        |                                |                       | Carrent / todact                   | e Content                               |         |
| Notes concerning ins                                      | stallation instruction | ns                             |                       |                                    |   |         |
|   |                        | Te                             | sting Profile Details |                                    | 770000000000000000000000000000000000000 |         |
|   | Leak                   |                                | Reference             | Flats Adjusted-                    |   |         |
|   | measurement            |                                | Temperature(℃)        | Gland Nut                          | Reference A                             |         |
| Test Segment  | (ppm)                  | Temperature(℃)                 | at packing gland      | Torque ft-lbs                      | Height (mm)                             |         |
| Day1  | 0                      | Room temp.                     | Room temp.            | 25                                 | 44.51                                   |         |
| -   | 0                      | Room temp.                     | Room temp.            |                                    |   |         |
| Start.Ambient   | 00                     | Room temp.                     | Room temp.            |                                    |   |         |
| 0-250 cycles  | 0                      | Room temp.                     | Room temp.            |                                    |   |         |
| P=136(bar)  | 00                     | Room temp.                     | Room temp.            |                                    |   |         |
|   | 0                      | Room temp.                     | Room temp.            |                                    |   |         |
| High Temperature  | 11                     | 260℃                           | 220℃                  |                                    |   |         |
| 250-500cycles   | 3                      | 260℃                           | 220°C                 |                                    |   | •       |
| <b>,</b>  | 6                      | 260℃                           | 220 °C                |                                    |   |         |
| P=110(bar) 7  |                        | 260°C                          | 220°C                 |                                    |   |         |
|   | 6                      | 260°C                          | 220℃                  |                                    |   |         |
|   | 2                      | Room temp.                     | Room temp.            |                                    |   |         |
| Day2  | 3                      | Room temp.                     | Room temp.            |                                    |   |         |
| Start,Ambient   | 3                      | Room temp.                     | Room temp.            |                                    |   |         |
| 500-750 cycles  | 6                      | Room temp.                     | Room temp.            |                                    | -                                       |         |
| •   | 8                      | Room temp.                     |                       |                                    |   | 47      |
| P=136(bar)  | 9                      | Room temp.                     | Room temp.            |                                    |   |         |
| High Temperature  |                        |                                | Room temp.            |                                    |   |         |
| riigii tettiperature                                      | 12                     | 260℃                           | 220°C                 |                                    |   |         |
| 750-1000 cycles   | 23                     | 260°C                          | 220℃                  |                                    |   |         |
| P=110(bar)  | 25                     | 260℃                           | 220°C                 |                                    |   |         |
|   | 26                     | 260℃                           | 220℃                  |                                    |   |         |
|   | 28                     | 260℃                           | 220℃                  |                                    |   |         |
| Day3  | 12                     | Room temp.                     | Room temp.            |                                    |   |         |
| Start.Ambient   | 22                     | Room temp.                     | Room temp.            |                                    |   |         |
| otart, Amplent  | 23                     | Room temp,                     | Room temp.            | 1                                  |   |         |
| 1000-1250 cycles  | 26                     | Room temp.                     | Room temp.            | -                                  |   |         |
| P=136(bar)  | 29                     | Room temp.                     | Room temp.            |                                    |   |         |
|   | 34                     | Room temp.                     | Room temp.            |                                    | BUREAU VERI                             | ZAS     |
| High Temperature  | 19                     | 260℃                           | 220℃                  |                                    | <b>☑</b> BEVIEWED                       |         |
| 1250-1500cycles   | 21                     | 260 °C                         | 220℃                  |                                    | WITNESSED                               | - Luft  |
| •   | 26                     | 260℃                           | 220℃                  |                                    | DATE                                    | 27      |
| P=110(bar)  | 29                     | 260℃                           | 220℃                  |                                    |   |         |
|   | 35                     | 260°C                          | 220℃                  |                                    |   |         |

| API Std 622  |   |
|--|---|
| Emissions Test   | ing Report Summary  |
| Test Number: SWI-FET-08                                      | Test Date: 21 <sup>st</sup> to 23 <sup>rd</sup> June , 2010 |
| Packing Material: Graphite, Graphite+ inconel wire           | Style Number:   |
| Packing Manufacturer: DAEWHA 6511+ 9001                      | Source of Sample: GATE BLWS A105N/13RFS SW 800# WB RB 1"    |
| Test Packing Cross-section: Rectangle                        | Laboratory Name: SWI LABORATORY                             |
| ,  | Location of Test: SWI FACTORY                               |
| Packing Gland OD and ID(at the packing):  OD= 17.6 ID= 11.1  | Packing Gland Bolf Diameter≒ 7.9 mm                         |
| Number of Mechanical Cycles: 750                             | Packing Compression % of Free Height= 80%                   |
|  | Torque on Gland Nuts(each side)= 25/25 (ft-lbs)             |
| Number of Thermal Cycles: 750                                | Mechanical Cycles Prior to Readjustment:  Non-applicable    |
| Maximum Test Pressure: 136 bar                               | Number of Readjustments: 0                                  |
| Packing Configuration: Graphite + Graphite with inconel wire | Show Sketch of Packing Installation-define each ring:       |
| Number of rings tested: 7                                    |   |
| Circle the following .                                       |   |
| Ring shape (square, circular, vee)                           |   |
| Solid or split   |   |
| Braided  |   |
| Die formed   | 1 1 1   |
| Spool stock  |   |
| Wire or other reinforcement  Corrosion inhibitor &type       |   |
| Other  |   |

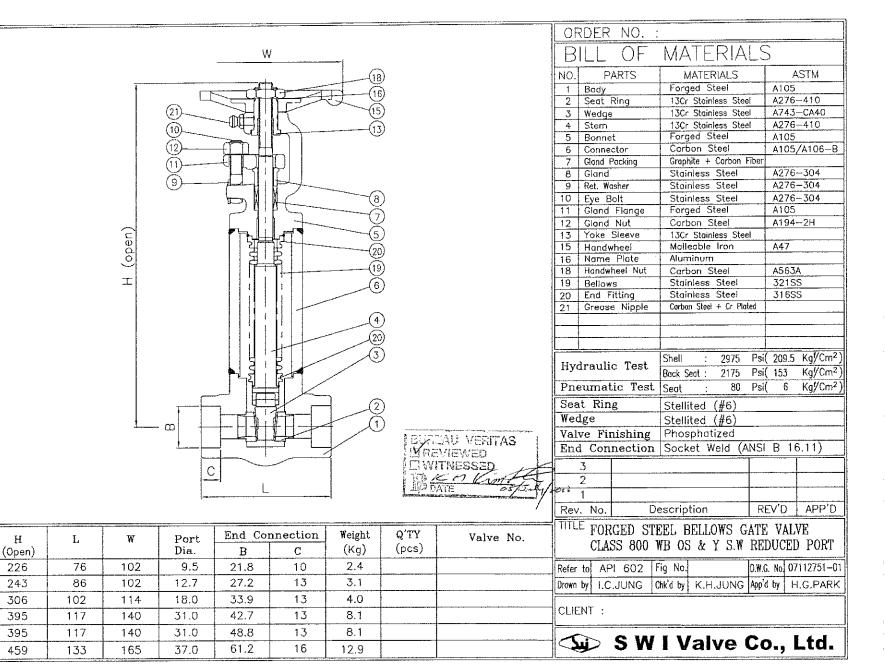


| TEST CHECKED BY:                  | TEST APPROVED BY :                  |
|-----------------------------------|-------------------------------------|
| JONG WOO , SOHN                   | YONG PYO, CHO                       |
|                                   | Y P Cho                             |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |



Bellows Gate

BUREAU VERITAS
DIREVIEWED
DIWITNESSED
DO DATE



SIZE

(Inch)

1/2

3/4

1 - 1/4

1 - 1/2

2

H

226

243

306

395

395

459



# TYPE APPOROVAL CERTIFICATE FOR GLOBE BELLOWS VALVE No. 940013/3-CT-09

| B.V. Job Ref: 3.30.1030.03   |  |   |  |
|--|--|---|--|
| Inspection ordered to B.V. by (1):   |  |   | n no Anno 1 Octobril de 16 de 1  |
|  |  | 1-dong,Donga  | n-gu, Anyang-si, Gyeonggi-do, Korea  |
| Manufacturer: SWI Valve Co. Ltd., (1) the addressee of the original of this certificate:   |  |   |  |
| Description of the Supply / Subjec   | t of inspection  | n :   |  |
| Product: Forged Steel Globe Bell<br>Size of Tested Valve: 1"<br>Material of Tested Valve: ASTM A105t<br>Class of Tested Valve: #800<br>Stem Diameter: 12.7 mm<br>Tightness class: below 100ppm<br>Endurance class: 1500cycles<br>Temperature range: Room temperatur<br>Packing adjustment number: 0  | ٧  |   |  |
| This certificate covers the whole of the supply:   | YES (no more insp  | ection planned)   | NO (part of the supply still to be inspected)  |
| Scope of the B.V. Survey :   |  |   |  |
| - Witness for Type Test of Fugitive Em   | ission Test  |   |  |
| This supply complies with the follo API 622 Type Testing of Process Valv (2) and only for parts of the document(s) which conc List of enclosures: Test Report for Following to enclosed list) The certificate is valid together with enclosures (if listed). Only Marking and Stamping on the item Particulars or comments: This is to certify that the following valves the Fugitive Emission Test in accordance. | ve Packing for Form the certification of ugitive Emission pages of enclosures (or ns: None | r parts of pages) which   | ns te provided by Bureau Veritas.  Pages are stamped, are considered as part of this certificate.  But Veritas and found to be satisfactory in |
| Date of Issuance : 07-July-2010  | Issued by :  |   | Validated by :   |
| Date of Inspection: 24 to 26-Jun-2010  |  | Kim   | Name : Y. M. Moon  |
| Location of Inspection : BV-Korea, Secu  | Sign :   | 120   | Sign: Wast   |
| This certificate is deriverered within the Scope of the General Con-<br>Ce Certificat est délivré dans le cadre des Conditions Générales d   | itions of Services of Burea<br>e Service du Bureau Verita                                  | EU Vertas<br>as   |  |
| This certificate is issued further to an inspection whose were limited by the terms and conditions of the contract. This certificate is NOT an indication that the item(s) is (a specific purpose and does not release the manufacture party from their respective duty, guarantee, obligation a relating to, without limitation, patents, workmanship, ma performance in operation and/or reliability.            | with BV principal.<br>are) fit for any<br>r, supplier and any<br>nd/or indemnity           | 1 May | SEOUL  |

Ad ME 9613b



REPORT.NO. SWI-FET-09

ISSUED DATE 05.JULY.2010

CHECKED BY JONGWOO,SOHN

APPROVED BY YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

Page 1 of 3

## PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 24<sup>th</sup> June,2010 to 26<sup>th</sup> June,2010

### 1 VALVE SPECIFICATION

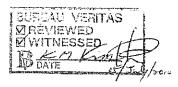
| Valve size & type  | GLOBE Bellows Valve A105N/13CRFS                 |  |  |
|--------------------|--|--|--|
|                    | SW 800# WB RB 1"                                 |  |  |
| Material of Valve  | A105N  |  |  |
| Valve class        | 800#   |  |  |
| Stem diameter      | 12.7 mm  |  |  |
| Gland packing type | Graphite Braided Packing+Graphite Molded Packing |  |  |
|                    | Model No. ; DAEWHA 6511+ 9001                    |  |  |
| Packing material   | Graphite , Graphite + Inconel Wire               |  |  |
| Operating torque   | 23 ft-lbs  |  |  |
| Stroke / Angle     | 7.8mm  |  |  |

### 2TEST CONDITION

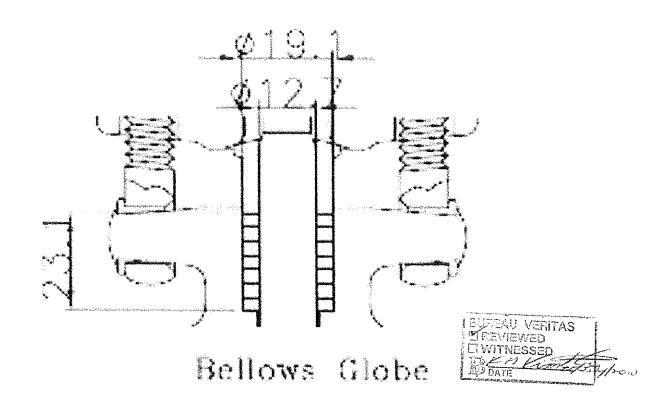
| Test pressure                 | 136-110bar                                   |                        |  |  |
|-------------------------------|--|------------------------|--|--|
| Test medium                   | He 99%                                       | He 99%                 |  |  |
| Check medium                  | He 99%                                       |                        |  |  |
| Test temperature              | RT/ 260℃                                     |                        |  |  |
| Test equipment                | Fugitive emission test                       | equip. manufactured by |  |  |
|                               | SWI VALVE CO. LTD.                           |                        |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series) |                        |  |  |
| Sampling method               | Random                                       | Random                 |  |  |
| Valve repacking before test   | 0  | BUREAU VERITAS         |  |  |
| Insulation of test valve      | Heating Jacket used                          | EWITNESSED             |  |  |
| Actuator                      | Geared motor                                 | W DATE                 |  |  |

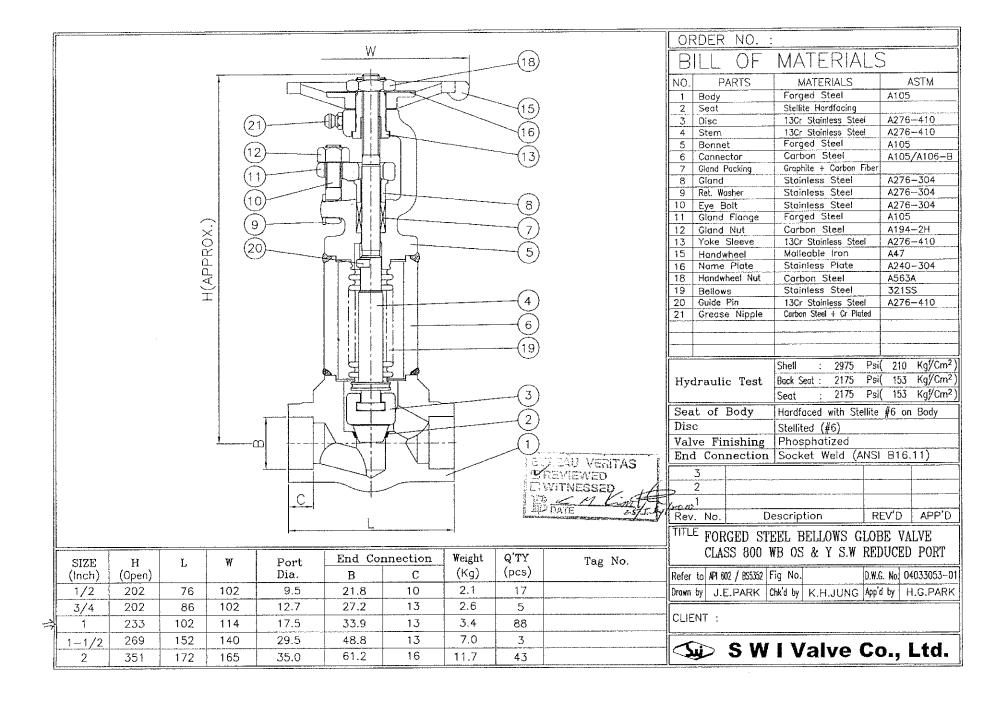
| Application Profile : 0               | Check One              |                              |                                  | Manufacturer: SW                                     | I VALVE CO. LTD.           |              |
|---------------------------------------|------------------------|------------------------------|----------------------------------|--|----------------------------|--------------|
|                                       | 1 Rising               |                              |                                  | Description: Globe BLWS A105N 800# 1"                |                            |              |
| Testing Facility: SWI                 | Factory                |                              |                                  |  |                            | •            |
| Technician: JongWoo,Sohn              |                        |                              | 1                                | iufacturer - Date: 10 <sup>th</sup> June<br>tributor | ,2010                      |              |
| Witness; Ki-Man , Kir                 |                        |                              |                                  | LJ DIS   | tuonfoi                    |              |
| Start date: 24 <sup>TH</sup> June     | ,2010                  | Completion: 26 <sup>TH</sup> |                                  | Packaged:<br>Indicate New or                         | 🗓 New                      |              |
| Gland Load                            |                        | Gland Nut Torqu              | e: 27 ft-lbs                     | Current Product                                      | ☑ Current                  |              |
| Information psi. Notes concerning ins | stallation instruction | ns                           |                                  |  | 7707                       |              |
|                                       |                        |                              |                                  |  |                            |              |
|                                       |                        | Te                           | sting Profile Details            |  |                            |              |
|                                       | Leak<br>measurement    |                              | Reference                        | Flats Adjusted-                                      | D-6 A                      |              |
| Test Segment                          | (ppm)                  | Temperature(°C)              | Temperature(°C) at packing gland | Gland Nut<br>Torque ft-lbs                           | Reference A<br>Height (mm) |              |
| - 3                                   | 0                      | Room temp.                   | Room temp.                       | 27   | 44.51                      |              |
| Day1                                  | 0                      | Room temp.                   | Room temp.                       |  |                            |              |
| Start,Ambient                         | 0                      | Room temp.                   | Room temp.                       |  |                            |              |
| 0-250 cycles                          | 0                      | Room temp.                   | Room temp.                       | 1  |                            |              |
| ,                                     | 0                      | Room temp.                   | T                                |  |                            |              |
| P=136 (bar)                           | 0                      |                              | Room temp.                       |  |                            |              |
| High Tamporatura                      |                        | Room temp.                   | Room temp.                       |  |                            |              |
| High Temperature                      | 2                      | 260 °C                       | 220°C                            | 1  |                            |              |
| 250-500cycles                         | 3                      | 260°C                        | 220°C                            |  |                            |              |
| P=110(bar)                            | 6                      | 260℃                         | 220 °C                           |  |                            |              |
|                                       | 8                      | 260°C                        | 220°C                            |  |                            |              |
|                                       | 8                      | 260°C                        | 220°C                            |  | ···········                |              |
| Day2                                  | 1                      | Room temp.                   | Room temp.                       |  |                            |              |
| Start, Ambient                        | 4                      | Room temp.                   | Room temp.                       |  |                            |              |
| ·                                     | 5                      | Room temp.                   | Room temp.                       |  |                            |              |
| 500-750 cycles                        | 5                      | Room temp.                   | Room temp.                       |  |                            |              |
| P=136(bar)                            | 6                      | Room temp.                   | Room temp.                       |  |                            |              |
|                                       | 8                      | Room temp.                   | Room temp.                       |  |                            |              |
| High Temperature                      | 11                     | 260°C                        | 220°C                            |  |                            |              |
| 750-1000 cycles                       | 15                     | 260℃                         | 220℃                             |  |                            |              |
| P=110(bar)                            | 15                     | 260 0                        | 220℃                             |  |                            | <del>,</del> |
| · rio(bar)                            | 17                     | 260℃                         | 220°C                            |  |                            |              |
|                                       | 18                     | 260°C                        | 220℃                             |  |                            |              |
| Day3                                  | 10                     | Room temp.                   | Room temp.                       |  |                            |              |
|                                       | 13                     | Room temp.                   | Room temp.                       |  |                            |              |
| Start, Ambient                        | 15                     | Room temp.                   | Room temp.                       |  |                            |              |
| 1000-1250 cycles                      | 16                     | Room temp.                   | Room temp.                       |  |                            |              |
| P=136(bar)                            | 18                     | Room temp.                   | Room temp.                       |  |                            |              |
| ,                                     | 19                     | Room temp.                   | Room temp.                       |  | BUREAU VERITAS             | -            |
| High Temperature                      | 22                     | 260℃                         | 220℃                             |  | MREVIEWED                  | <u> </u>     |
| 1250-1500cycles                       | 23                     | 260℃                         | 220°C                            |  | ITIWITNESSED               | W.           |
| ·                                     | 24                     | 260 °C                       | 220℃                             |  | B DATE                     | l'estre      |
| P=110(bar)                            | 28                     | 260°C                        | 220℃                             |  |                            | Marian '     |
|                                       | 32                     | 260°C                        | 220°C                            |  |                            |              |

| API Std 622  |   |  |  |
|--|---|--|--|
| Emissions Test   | ing Report Summary  |  |  |
| Test Number: SWI-FET-09                                      | Test Date: 24 <sup>TH</sup> to 26 <sup>TH</sup> June , 2010 |  |  |
| Packing Material: Graphite, Graphite+ inconel wire           | Style Number:   |  |  |
| Packing Manufacturer: DAEWHA 6511+ 9001                      | Source of Sample: GLOBE BLWS A105N/13RFS SW 800# WB RB 1"   |  |  |
| Test Packing Cross-section: Rectangle                        | Laboratory Name: SWI LABORATORY                             |  |  |
|  | Location of Test: SWI FACTORY                               |  |  |
| Packing Gland OD and ID(at the packing):  OD= 17.6 ID= 11.1  | Packing Gland Bolt Diameter= 7.9 mm                         |  |  |
| Number of Mechanical Cycles: 750                             | Packing Compression % of Free Height= 80%                   |  |  |
|  | Torque on Gland Nuts(each side)= 27/27 (ft-lbs)             |  |  |
| Number of Thermal Cycles: 750                                | Mechanical Cycles Prior to Readjustment:                    |  |  |
|  | Non-applicable  |  |  |
| Maximum Test Pressure: 136 bar                               | Number of Readjustments: 0                                  |  |  |
| Packing Configuration: Graphite + Graphite with inconel wire | Show Sketch of Packing Installation-define each ring:       |  |  |
| Number of rings tested: 7                                    |   |  |  |
| Circle the following   |   |  |  |
| Ring shape (square, circular, vee)                           |   |  |  |
| Solid or split   |   |  |  |
| Braided  |   |  |  |
| Die formed   | 1 1 1 1   |  |  |
| Spool stock  |   |  |  |
| Wire or other reinforcement                                  |   |  |  |
| Corrosion inhibitor &type                                    |   |  |  |
| Other  |   |  |  |



| TEST CHECKED BY:                  | TEST APPROVED BY :                  |
|-----------------------------------|-------------------------------------|
| JONG WOO, SOHN                    | YONG PYO, CHO                       |
| 1                                 | y p che                             |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |







## TYPE APPOROVAL CERTIFICATE FOR 2-P TRUNNION BALL VALVE No. 940013/3-CT-10

| IV  | 0. 94001   | 3/3-61-                            | 10  |                   |
|---|--|------------------------------------|---|-------------------|
| B.V. Job Ref: 3.30.1030,03  |  |                                    |   |                   |
| Inspection ordered to B.V. by (1): #102   |  |                                    | an-gu, Anyang-si, Gyeon                     | ggi-do, Korea     |
| Manufacturer : SWI Valve Co. Ltd., (1) the addressee of the original of this certificate  |  |                                    |   |                   |
| Description of the Supply / Subjec  | t of inspectio   | n:                                 |   |                   |
| Product: Cast Steel 2-P Trunnion Size of Tested Valve: 4" Material of Tested Valve: ASTM A216- Class of Tested Valve: #600 Stem Diameter: 36.0 mm Tightness class: below 100ppm Endurance class: 1500cycles Temperature range: Room Temperature Packing adjustment number: 0  | WCB  |                                    |   |                   |
| This certificate covers the whole of the supply: ⊠  | YES (no more insp  | pection planned) [                 | NO (part of the supply still to b           | pe inspected)     |
| Scope of the B.V. Survey :  |  |                                    |   |                   |
| - Witness for Type Test of Fugitive Em  | ission Test  |                                    |   |                   |
| - API 622 Type Testing of Process Val<br>(2) and only for parts of the document(s) which con<br><b>List of enclosures</b> : Test Report for Fi<br>(or reference to enclosed list)<br>The certificate is valid together with enclosures (if listed). Only  | ugitive Emission   | or the relevant sen                | 6 Pages                                     | this certificate. |
| Marking and Stamping on the iten  | ns: None   |                                    |   |                   |
| Particulars or comments: This is to certify that the following valves The Fugitive Emission Test in accordance  | s have been insp<br>ce with API 622  | pected by Bure<br>First Edition, . | eau Veritas and found to be<br>August 2006. | e satisfactory ir |
| Date of Issuance: 07-July-2010<br>Date of Inspection: 28 to 30-Jun-2010   | Issued by :<br>Name : K. M. I  | Kim<br>/                           | Validated by :<br>Name : Y. M. Moon         | (                 |
|   | Sign:  | C.                                 | Sign:                                       |                   |
| Location of Inspection : BV-Korea, Seot  This certificate is deliverered within the Scope of the General Con Ce Certificat est delivre dans le cadre des Conditions Génerales de  | ditions of Services of Bure  | au Ventas                          |   |                   |
| This certificate is issued further to an inspection whose were limited by the terms and conditions of the contract. This certificate is NOT an indication that the item(s) is (a specific purpose and does not release the manufacture party from their respective duty, guarantee, obligation a relating to, without limitation, patents, workmanship, ma performance in operation and/or reliability. | duration and scope<br>with BV principal,<br>are) fit for any<br>r, supplier and any<br>nd/or indemnity |                                    | SEQUE)                                      |                   |

Ad ME 9613b



 REPORT.No.
 SWI-FET-10

 ISSUED DATE
 05.July.2010

 CHECKED BY
 JONGWOO,SOHN

 APPROVED BY
 YONGPYO,CHO

FUGITIVE EMISSION PROTOTYPE (TAT) ACCEPTANCE TESTING < API 622 >

Page 1 of 3

## PROTOTYPE TEST FOR VALVE ACCORDING TO API 622 FIRST EDITION , AUGUST 2006.

- Fugitive Emission Test equipment specification

1. Manufacturer: SWI VALVE CO. LTD.

2. Address: 1023-2 Gwanyang 1-dong, Dongan-gu,

Anyang-si, Gyeonggi-do, Korea

3. Date of Test: 28<sup>th</sup> June,2010 to 30<sup>th</sup> June,2010

### 1 VALVE SPECIFICATION

| Valve size & type  | 2P-TRUNNION BALL VALVE WCB/316+RTFE |
|--------------------|-------------------------------------|
|                    | RF FB 600# 4"                       |
| Material of Valve  | A216-WCB                            |
| Valve class        | 600#                                |
| Stem diameter      | 36.0 mm                             |
| Gland packing type | Graphite Molded Packing             |
| Packing material   | FKM+Graphite                        |
| Operating torque   | 292 ft-lbs                          |
| Stroke/ Angle      | Quarter-turn                        |

### 2TEST CONDITION

| _,,                           |   |                |  |  |
|-------------------------------|---|----------------|--|--|
| Test pressure                 | 102-88 bar                                    |                |  |  |
| Test medium                   | He 99%  |                |  |  |
| Check medium                  | He 99%  |                |  |  |
| Test temperature              | RT/ 200℃                                      |                |  |  |
| Test equipment                | Fugitive emission test equip, manufactured by |                |  |  |
|                               | SWI VALVE CO. LTD.                            |                |  |  |
| Leakage measurement equipment | Helium Detector(ALCATEL Model ASM142 series)  |                |  |  |
| Sampling method               | Random  |                |  |  |
| Valve repacking before test   | 0   | BUREAU VERITAS |  |  |
| Insulation of test valve      | Heating Jacket used                           | I WITNESSED    |  |  |
| Actuator                      | Geared motor                                  | W DATE         |  |  |

FORM-FET-01

SWI VALVE CO.LTD.

| API Std 622  | Funitive Emis          | ssions Testing Report   | Number: SW/LEET.                   |   |  |  |
|--|------------------------|---|------------------------------------|---|--|--|
| Application Profile : 0                              |                        |   | INTRIDET, CAMPI E 1-               | V                                       | /IN/ALVE COLLED                                      |  |
| Application Profile : Check One  ☑ Rotating □ Rising |                        | Manufacturer: SWI VALVE GO. LTD. Description: 2-P Trunnion Ball WCB 600# 4* |                                    |   |  |  |
| Testing Facility: SWI                                | Factory                |   |                                    |   |  |  |
| Technician: JongWoo                                  | o,Sohn                 |   |                                    |   | nufacturer - Date: 10 <sup>th</sup> Jur<br>stributor | ie,2010  |
| Witness: Ki-Man , Ki                                 |                        | 71  |                                    | ; Dis                                   | trioutor   |  |
| Start date: 28 <sup>™</sup> Jur                      | ne,2010                | Completion: 30 <sup>TH</sup>  | June,2010                          | Packaged:<br>Indicate New or            | 🖺 New  | ana e composito de la composit |
| Gland Load   |                        | Gland Nut Torque : 3  | 39 ft-lbs                          | Current Product                         | ☐ New ☐ Current                                      |  |
| Information psi.  Notes concerning ins               | stallation instruction | ns  |                                    |   |  |  |
|  |                        |   |                                    |   |  |  |
| · · · · · · · · · · · · · · · · · · ·                | Leak                   | Te:   | sting Profile Details<br>Reference | Flats Adjusted-                         | <del></del> -  |  |
|  | measurement            |   | Temperature(°C)                    | Gland Nut                               | Reference A  |  |
| Test Segment   | (500 ppm)              | Temperature(°C)   | at packing gland                   | Torque ft-lbs                           | Height (mm)  |  |
| Day1   | 0                      | Room temp.  | Room temp.                         | 39                                      | 44.50  |  |
|  | 0                      | Room temp.  | Room temp.                         |   |  |  |
| Start,Ambient  | 0                      | Room temp.  | Room temp.                         |   |  |  |
| 0-250 cycles   | 0                      | Room temp.  | Room temp.                         |   |  |  |
| P=102 (bar)  | 0                      | Room temp.  | Room temp.                         |   |  |  |
|  | 0                      | Room temp.  | Room temp.                         |   |  |  |
| High Temperature                                     | 0                      | 200°C   | 176℃                               |   |  |  |
| 250-500cycles  | 0                      | 200°C   | 176°C                              |   |  |  |
| P=88(bar)  | 0                      | 200℃  | 176°C                              |   |  |  |
| 1 -00(041)   | 11                     | 200℃  | 176℃                               |   |  |  |
|  | 2                      | 200°C   | 176°C                              |   |  |  |
| Day2   | . 0                    | Room temp.  | Room temp.                         |   |  |  |
| ,  | 0                      | Room temp.  | Room temp.                         |   |  |  |
| Start,Ambient  | 2                      | Room temp.  | Room temp.                         |   |  |  |
| 500-750 cycles                                       | 3                      | Room temp.  | Room temp.                         |   |  |  |
| P=102(bar)   | 3                      | Room temp.  | Room temp.                         |   |  |  |
|  | 5                      | Room temp.  | Room temp.                         |   |  |  |
| High Temperature                                     | 12                     | 200°C   | 176°C                              |   |  |  |
| 750-1000 cycles                                      | 13                     | 200℃  | 176°C                              |   |  |  |
| P=88(bar)  | 15                     | 200℃  | 176°C                              | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |  | ···  |
| 1 -00(Dai)   | 15                     | 200℃  | 176℃                               |   |  |  |
|  | 16                     | 200℃  | 176°C                              |   |  |  |
| Day3   | 8                      | Room temp,  | Room temp.                         |   |  |  |
|  | 9                      | Room temp.  | Room temp.                         |   |  |  |
| Start,Ambient  | 10                     | Room temp.  | <ul> <li>Room temp.</li> </ul>     |   |  | ,  |
| 1000-1250 cycles                                     | 11                     | Room temp.  | Room temp.                         |   |  |  |
| P=102(bar)   | 11                     | Room temp.  | Room temp.                         |   |  |  |
|  | 12                     | Room temp.  | Room temp.                         |   |  | SSSS-  |
| High Temperature                                     | 15                     | 200℃  | 176℃                               |   | UREAU VERITAS  |  |
| 1250-1500cycles                                      | 16                     | 200℃  | 176℃                               |   | WITNESSED  | 4  |
| P=88(bar)  | 18                     | 200°C   | 176℃                               |   | KAKAME   | 14/52/   |
| r =50(0a1)   | 18                     | 200℃  | 176℃                               | į,                                      | DATE 05/C  | - 30 SOL   |
|  | 23                     | 200℃  | 176°C                              |   |  |  |
| A graph depicting th                                 | e test profile with a  | associated leak check   | s and reajustments                 | shall be provide by                     | the testing authority.                               |  |

| API Std 622                                  |   |
|--|---|
| Emissi                                       | ons Testing Report Summary                                      |
| Test Number: SWI-FET-10                      | Test Date: 28 <sup>TH</sup> to 30 <sup>TH</sup> June,2010       |
| Packing Material: FKM+ Graphite              | Style Number:   |
| Packing Manufacturer: PPE                    | Source of Sample: 2-P TRUNNION BALL WCB/316+RTFE  RF FB 600# 4" |
| Test Packing Cross-section: (circular)       | Laboratory Name: SWI LABORATORY                                 |
| o-ring / Rectangle                           | Location of Test; SWI FACTORY                                   |
| Packing Gland OD and ID(at the packing):     | Packing Gland Bolt Diameter= 12.7mm                             |
| OD= 41 ID= 35                                |   |
| Number of Mechanical Cycles: 750             | Packing Compression % of Free Height= 100 %                     |
|  | Torque on Gland Nuts(each side)≃ 39/ 39 (ft-lbs)                |
| Number of Thermal Cycles: 750                | Mechanical Cycles Prior to Readjustment:                        |
|  | Non-applicable  |
| Maximum Test Pressure ; 102 bar              | Number of Readjustments: 0                                      |
| Packing Configuration: FKM + GRAPHITE        | Show Sketch of Packing Installation-define each ring:           |
| Number of rings tested: 3 Oring + 2 GRAPHITE | +                         |
| Circle the following                         |   |
| Ring shape(square, circular, vee)            |   |
| Solid or split                               |   |
| Braided                                      |   |
| Die formed                                   |   |
| Spool stock                                  | 22 3 7 7  |
| Wire or other reinforcement                  |   |
| Corrosion inhibitor &type                    |   |
| Other  |   |

| TEST CHECKED BY :                 | TEST APPROVED BY:                   |
|-----------------------------------|-------------------------------------|
| JONG WOO , SOHN                   | YONG PYO, CHO                       |
| DATE: July 5 <sup>TH</sup> , 2010 | DATE: : July 5 <sup>TH</sup> , 2010 |

